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A COMPREHENSIVE PROGRAM FOR CONTROL OF WATER POLLUTION IN THE MISSOURI DRAINAGE BASIN

Public Health Service
Kansas City, Missouri

July 1953

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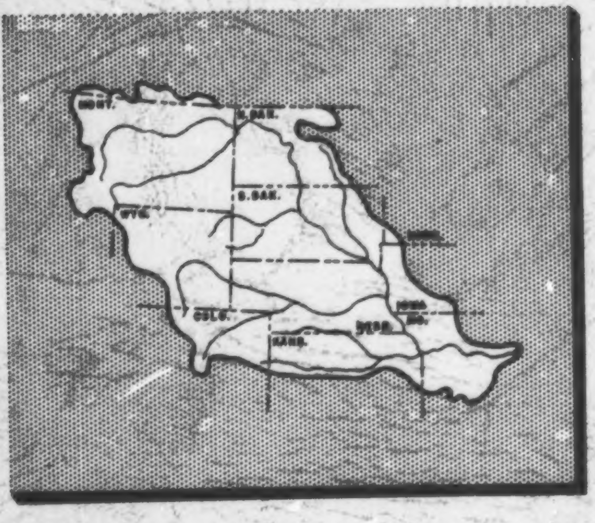
A COMPREHENSIVE PROGRAM FOR CONTROL OF WATER POLLUTION

Missouri Drainage Basin

A COOPERATIVE STATE-FEDERAL REPORT ON WATER POLLUTION

July 1953



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A COMPREHENSIVE PROGRAM
FOR
CONTROL OF WATER POLLUTION
IN THE
MISSOURI RIVER DRAINAGE BASIN

Adopted by

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Public Health Service

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July 1953
Division of Water Pollution Control
Missouri Drainage Basin Office

I

A COMPREHENSIVE PROGRAM FOR CONTROL OF WATER POLLUTION
IN THE MISSOURI RIVER DRAINAGE BASIN

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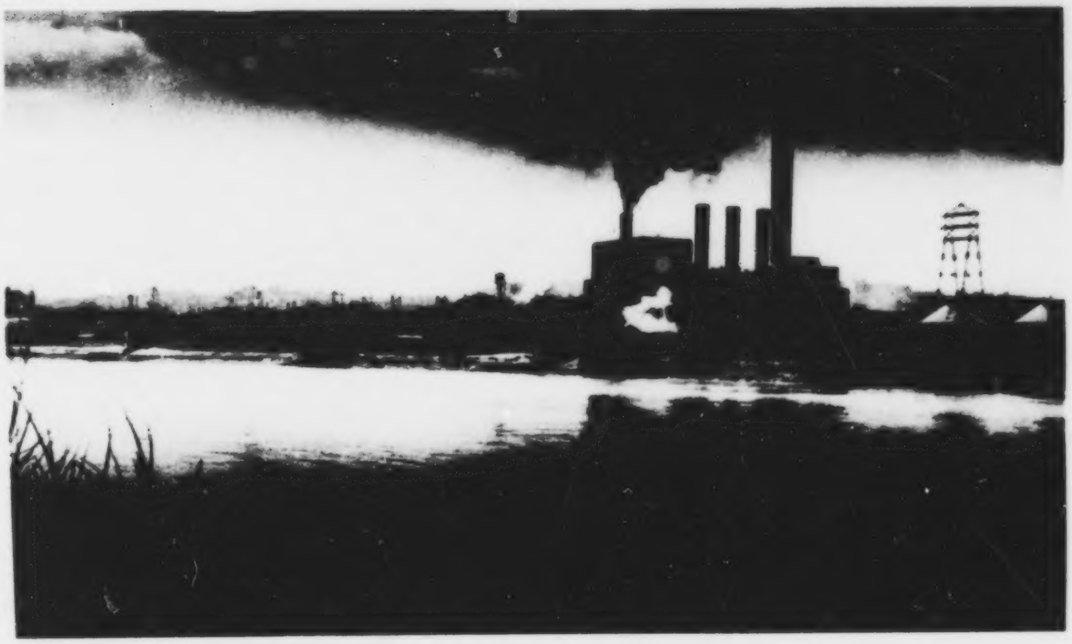
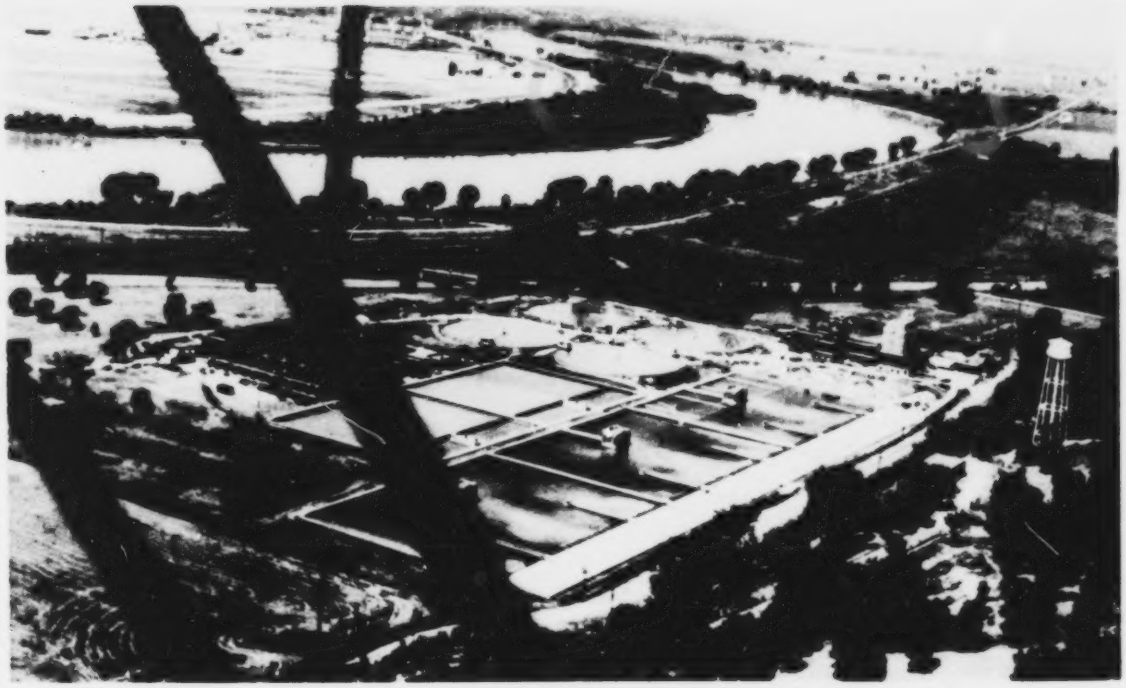


The Missouri River mirrors industrial development



A Missouri River water treatment plant

PART I -- MISSOURI RIVER DRAINAGE BASIN REPORT

FOREWORD

Our country's development over the past 50 years has been marked by tremendous progress in many fields. It has made possible great gains in the health, comfort, and well-being of the people. But it has not been without cost. Part of the cost has been the damage to the Nation's water resources that has resulted from wastes discharged to the streams by our growing cities and industries. All water uses have been affected -- public water supplies, recreation, agriculture, industry, fish and aquatic life.

In enacting the Federal Water Pollution Control Act in 1948, the Congress declared that "water pollution has become a matter of grave concern in many areas and its damaging effects on the public health and national resources are a matter of definite Federal concern as a menace to national welfare. Abatement must be undertaken in order to control it."

The Public Health Service, as part of its responsibilities under this Act, is required to prepare or adopt, in cooperation with other Federal agencies, State and interstate water pollution control agencies, and municipalities and industries, comprehensive programs for the abatement of pollution.

This publication summarises the comprehensive water pollution control program for the Missouri Drainage Basin developed by the respective State Water Pollution Control Agencies. The program is sound and gives full consideration to the several present uses and to the reasonably-anticipated future uses of the waters of the Missouri River Basin. It provides an equitable balance in the pollution control requirements for various private and public groups concerned.

I am pleased, therefore, in my capacity as Surgeon General of the Public Health Service, to adopt the program developed by the States for the Missouri River Basin, as a comprehensive program which fully meets the requirements of the Federal Water Pollution Control Act.

This program is based on beneficial water uses and related conditions that prevailed on January 1, 1953. Comprehensive programs for pollution control must necessarily be flexible. They must allow for growth, development, and changing conditions. Any significant changes affecting water quality, such as stream flow, water use, industrial development, population, etc., may require changes in the pollution control program.

Obviously the mere adoption of this program will not, in itself, reduce pollution or improve the usefulness of the waters in the Missouri River Basin. It does provide to the citizens of the area and to the city officials and industrial leaders, farmers, fishermen, conservationists, and others an objective plan based on good engineering practice, and reflecting sound economics. It is a plan which the public can support, and must support, if progress is to be made in the abatement of pollution.

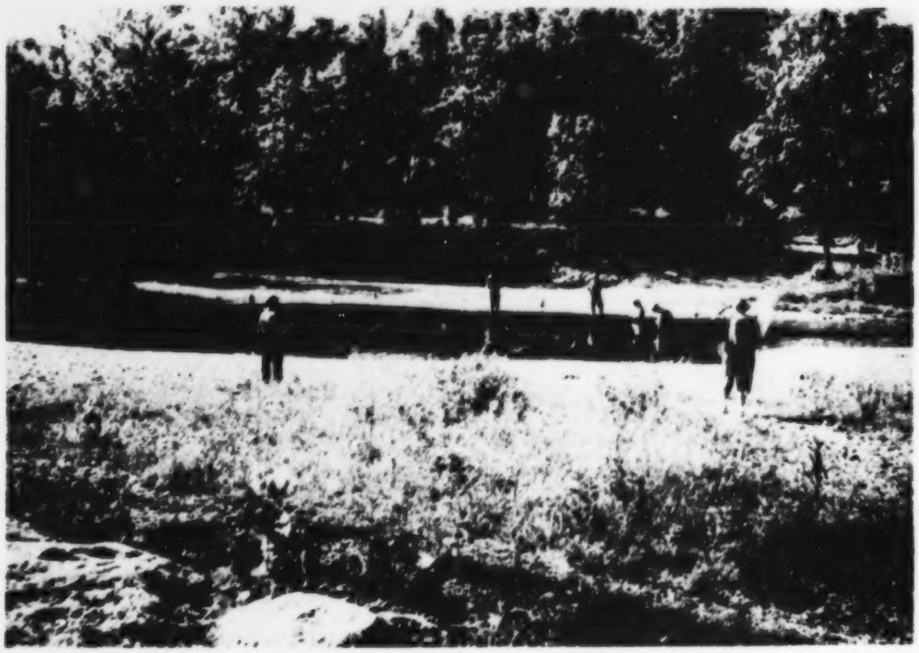
Certain additional considerations beyond the mere acceptance of a plan are essential to its successful execution. The citizens of the areas affected must see that sufficient resources are provided to the State water pollution control agencies concerned to enable them to make the technical investigations necessary to aid those responsible for constructing pollution abatement works.

We must recognize, too, that in order to be fully effective the plans and programs of one State must be geared closely to those of adjoining States, since State boundaries are no barrier to pollution traveling in interstate streams. Above all, no program of this nature can progress beyond the report stage if its meaning and purpose are not made clear and understandable to the citizens of the area. In the final analysis they are the ones who will pay, directly or indirectly for the pollution abatement works that are needed.

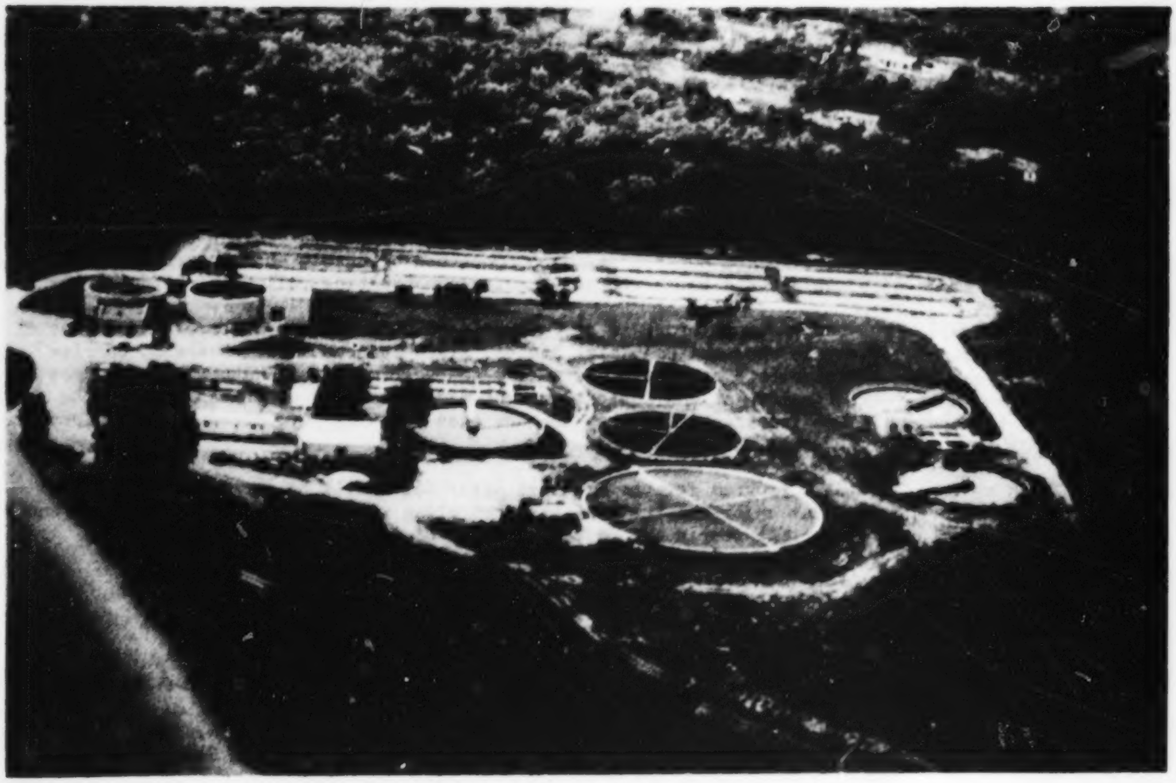
It is my hope that this program for the Missouri River Basin will be carried through to completion so that the area may enjoy all the benefits that clean water can provide, in health and recreational opportunities for the people and in sound growth of industry and agriculture.

Leonard A. Scheele

Leonard A. Scheele
Surgeon General



Trout fishermen in the clear cold water of the Upper Niangua River



Sewage treatment plants alleviate stream pollution

INTRODUCTION

The Federal Water Pollution Control Act, Public Law 845, passed by the 80th Congress in June of 1948, requires the Surgeon General of the Public Health Service to cooperate with other Federal Agencies, with State and Interstate Water Pollution Control Agencies, and with municipalities and industries in the preparation or adoption of comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof, and improving the sanitary condition of surface and underground waters.

In developing these programs, due regard must be given to improvements necessary to conserve the Nation's waters for public water supplies, propagation of fish and aquatic life, recreational purposes, and agricultural, industrial, and other legitimate uses.

Recognizing that full technical information was not available to permit the development of such comprehensive programs immediately for most of the Nation's waters, the Public Health Service envisioned the development of these programs in two general phases. The first phase contemplated the development of a series of reports, consistent with presently available data, which would: provide a reference point for measuring progress; provide a guide to needed additional data; provide a basis for the logical development of comprehensive programs; and serve to inform the public on the problem of water pollution and set forth suggestions for pollution control.

These reports were to represent information about the ways our water resources are used, the pollution going into our water resources and the resulting damages, the benefits which may result from pollution prevention and abatement, the pollution prevention measures now in effect, and the pollution control measures required. This portion of the objective has been completed by the publication of the following reports covering the 14 Sub-Basins of the Missouri River drainage area:

1. Big Sioux River Drainage Basin - A Cooperative State-Federal Report on Water Pollution - October 1951
2. Central Missouri River Drainage Basin - A Cooperative State-Federal Report on Water Pollution - June 1952
3. Grand-Chariton Drainage Basins - A Cooperative State-Federal Report on Water Pollution - June 1952
4. James River Drainage Basin - A Cooperative State-Federal Report on Water Pollution - April 1952
5. Kansas River Drainage Basin - A Cooperative State-Federal Report on Water Pollution - February 1953
6. Lower Missouri River Basin Water Pollution Investigation - A Cooperative State-Federal Report on Water Pollution - October 1952
7. Lower Platte River Basin Water Pollution Investigation - June 1950

8. Missouri-Souris Development Area Water Pollution Investigation - A Cooperative State-Federal Report on Water Pollution - November 1951

9. Niobrara River Basin Water Pollution Investigation - January 1951

10. North Platte River Basin Water Pollution Investigation - January 1951

11. Osage-Gasconade Drainage Basins - A Cooperative State-Federal Report on Water Pollution - March 1952

12. South Platte River Drainage Basin - A Cooperative State-Federal Report on Water Pollution - February 1953

13. Upper Missouri River Drainage Basin - A Cooperative State-Federal Report on Water Pollution - May 1952

14. Yellowstone River Drainage Basin - A Cooperative State-Federal Report on Water Pollution - January 1952

The second phase, as represented by this report, is the adoption by the Surgeon General of the Public Health Service of a comprehensive water pollution control program for the Missouri River Drainage Basin as developed by the State Water Pollution Control Agencies. Included is a project list by States indicating sewage and industrial waste treatment needs. Sub-Basin sections include a list of all sources of pollution by river location.

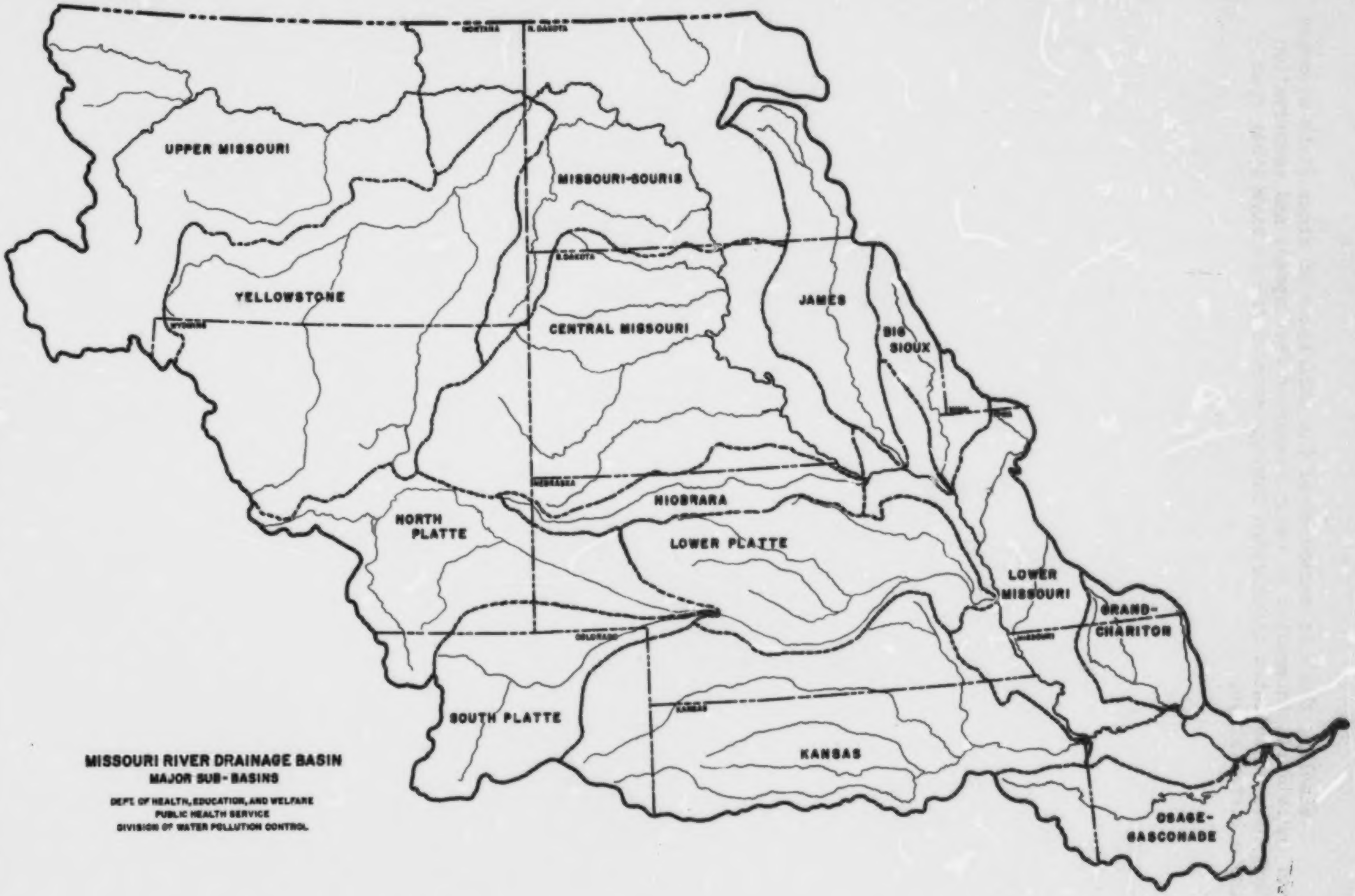
Acknowledgments

The Public Health Service wishes to acknowledge the cooperation and assistance of those agencies and individuals that have contributed to the preparation of this report.

The Water Pollution Control Agencies of the States in the Basin - the Colorado Department of Public Health, Iowa State Department of Health, Kansas State Board of Health, Minnesota Department of Health, Missouri Division of Health, Montana State Board of Health, Nebraska Department of Health, North Dakota State Department of Health, Committee on Water Pollution of the State of South Dakota, and the Wyoming Department of Public Health - have furnished the data from which the various tables were prepared and other data and information contained in the narrative statements. These agencies have also reviewed the preliminary draft of the report and have offered valuable comment.

Federal agencies which have reviewed the preliminary draft of the report include the Corps of Engineers, Department of the Army; Bureau of Reclamation, Fish and Wildlife Service, Geological Survey, and National Park Service, Department of the Interior; Department of Agriculture; Department of Commerce; Federal Power Commission and the Department of Labor. They have contributed to the development of this report by their comments and by providing pertinent data.

Finally, there is acknowledged the assistance of other State agencies and individuals interested in water resources development and conservation that have contributed information through sources and in ways other than those listed above.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MISSOURI
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KANSAS
KANSAS
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MISSOURI RIVER DRAINAGE BASIN
MAJOR SUB-BASINS

DEPT. OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
DIVISION OF WATER POLLUTION CONTROL

GENERAL DESCRIPTION

The Missouri River has been given many names. Historians sometimes refer to it as the River of Empire; the people who come in daily contact with it picturesquely call it Smoky Water, Big Muddy, or Wild Missouri.

The first territory of the Missouri Drainage Basin to be visited by white men was central Kansas and central Nebraska. About 1540 the Spanish explorer Coronado visited this region in his attempt to find the seven cities of gold. As far as it is possible to determine, white men did not again see this area until nearly 50 years later when two more Spanish explorers entered the same territory. It is doubtful whether the Spanish explorers ever viewed the main stem of the Missouri River.

The first white men to see the mouth of the Missouri River were two French explorers, Father Marquette, and Joliet the trader, who reached the mouth in June 1673 on their journey down the Mississippi River. Father Marquette's log of the incident reveals that he was amazed by what he saw. "I have seen nothing more frightful, a mass of large trees, real floating islands were issuing from the mouth of Pekitanoui." His Indian guides called the river "The Pekitanoui" meaning Muddy River. He renamed it the Missouri. The exact meaning of the word Missouri is still in doubt, however, it is believed to have been taken from the name of a tribe of Indians residing near the river's mouth.

During the Nineteenth Century the river became a vast artery of commerce. Steamboats in great numbers plied the river from St. Louis to the mouth of the Yellowstone, carrying enormous volumes of commerce and great numbers of passengers. In the covered wagon days thousands of wagons traveled on boats from St. Louis to Kansas City or St. Joseph before their wheels touched the grass of the great plains. It was in this era that the settling of the West began. Among the great mass emigrations of this period were the movement of the Mormon people across the Basin into Utah, the emigration from the East to California caused by the gold rush, and the trek over the Oregon Trail to the Northwest. In addition to these movements, there was a steady flow of immigrants into the Basin itself where they were privileged to acquire land under the Homestead Acts. Following the Civil War, the railroads, with their ribbons of steel, reached across the Missouri River and began to fan out in several directions across the plains. Thus was ushered in the present era.

The Missouri River Basin lies between the 90th and 114th meridians west, and between the 37th and 50th parallels north. The area, with a maximum width of 700 miles and a length of 1,300 miles, occupies parts or all of the States of Montana, Wyoming, Colorado, North Dakota, South Dakota, Nebraska, Iowa, Kansas, Missouri, and Minnesota. It encompasses 529,400 square miles of which 9,700 square miles are in the Dominion of Canada. In addition, the scope of this report includes 12,800 square miles of the Souris Valley and Devils Lake Area in North Dakota. The Missouri River Basin represents about one-sixth of the entire land surface of the United States. Natural boundaries are the Rocky Mountains Uplift on the west, the Hudson Bay Drainage Basin to the north, the Mississippi Drainage Basin on the east, and the Ozark Uplift and the Arkansas River Basin to the south.

The main stem of the Missouri River, formed by the junction of the Jefferson, Gallatin, and Madison Rivers near Three Forks, Montana, extends 2,550 river miles to its confluence with the Mississippi at a point just above St. Louis, Missouri. Together with the Lower Mississippi River it forms the third longest river system in the world, while the Missouri alone is the longest river in North America. The major tributaries of the Missouri include the Yellowstone, Platte, and Kansas Rivers. Numerous other tributaries flow into the river throughout its entire length. The headwaters of the main stem, Yellowstone, North Platte and the South Platte Rivers rise along the eastern slope of the Continental Divide at about 13,000 feet elevation. In contrast to the high level of the headwaters, the mouth of the Missouri River is about 400 feet above mean sea level.

West of the 98th meridian, the semiarid climate provides a yearly rainfall varying over the region from 8 to 18 inches. The area east of the 98th meridian is much more humid and receives an annual rainfall varying from 18 to 50 inches. Temperatures within the Basin are extremely variable, caused by differences both in elevation and in latitude. The mean annual temperature of mountainous areas of the upper Missouri Basin is approximately 32° F., while that near the mouth of the Missouri is about 56° F. The growing season varies from a few weeks to six months.

USES OF WATER RESOURCES

Uses of water west of the 98th meridian are extensive and include domestic and municipal water supply, irrigation, development of hydroelectric power, livestock watering, the propagation and support of fish and wildlife, recreation, and for cooling and processing at industrial installations. East of the 98th meridian the waters are used principally for sources of domestic and municipal supplies, to meet demands by industry for water for processing and cooling, for removal of industrial and domestic wastes, for navigation, for game and commercial fishing, for recreation, for a limited amount of livestock watering, and to support wildlife. In terms of volume of water, west of the 98th meridian irrigation and power demands exceed other uses, while east of the 98th meridian demands for industrial, municipal, and navigation purposes are greatest. The 98th meridian divides the Basin so that essentially one-third is to the east and about two-thirds to the west of this line.

West of the 98th meridian there are critical shortages of water. For example, in the South Platte Basin a combination of industrial development, a large urban population, and a tremendous irrigation demand have exceeded the volume of water available, and keen competition for such water as is available is very much in evidence. Other sections west of the 98th meridian where water volume is seldom sufficient to meet all demands include those drained by the Cheyenne and Belle Fourche Rivers in eastern Wyoming and central South Dakota, in the North Platte River below Casper, Wyoming, and along the upper section of the Lower Platte. Eastern Colorado, southern Nebraska, and northwestern Kansas place a considerable value on the available water resources. There are numerous areas in the States of Wyoming, South Dakota, North Dakota, Montana, and Colorado where local conditions are such that the very existence of the inhabitants and livestock depend on the meager water supplies available from surface runoff. It is in these areas where major efforts have been made to conserve and reclaim waters for multiple-purpose benefits.

East of the 98th meridian water resources are seldom critical except in times of extreme low flows. However, during these periods the situation has in the past become precarious because of the dependency placed on water resources by the large municipalities and industrial installations which support more than one-half of the Basin's population. Stream regulation and low flow augmentation through the Basin Land and Water Resources Development Program holds promise for alleviation of this condition at numerous locations.

In order to indicate the importance of the several major uses of surface water in the Missouri River Drainage Basin, the following demands are cited: 202 munipal surface water supplies serving over 3,031,000 persons with 460 million gallons daily; irrigation of 12 million acres; nearly 2 billion gallons daily for industrial cooling and processing purposes; removal and ultimate disposal of the liquid wastes of 1,073 municipalities and 332 industrial plants; navigation in the main stem of the Missouri River from Sioux City to its mouth requiring currently a discharge of 30,000 second-feet at Sioux City during the open water season and which may upon completion of the project run as low as 25,000 second-feet under conditions of short water supply; generation of 4 billion kilowatt-hours of electricity annually; 15 million man days annually of recreational and game fishing time; for support of many thousands of pounds of commercial fish caught annually; and water for many millionsof farm animals. Ground waters supply 1,266 municipal systems serving 1,600,000 persons with 193 million gallons each day, numerous industries, a small part of the irrigation demands, and considerable livestock water. The needs cited above are for the most part current and do not reflect ultimate requirements.

WATER QUALITY OBJECTIVES

Present water uses, increased usability due to improved water quality, and protection of water rights and property values largely determine pollution control measures needed. The goal of water pollution control programs is to preserve water quality to best serve these interests.

The Engineering Section of the Missouri Basin Health Council, consisting of the chief sanitary engineers of the 10 Basin States, adopted on February 27, 1952, tentative objectives as a guide* for water pollution control programs in the Basin. The tentative guide has been employed by the States in the development of their comprehensive program as presented in this report. It is recognized by the States that changes in conditions, particularly as they may affect water uses, and alterations in types of water uses, may require future moderations in any established standards. The tentative objectives as adopted by the States of the Basin are quoted as follows:

> "Subject to (a) such higher objectives as may be desired by any State and (b) such other modification as may be deemed necessary, after appropriate investigation, by the State Water Pollution Control Agency concerned, the Engineering Section, Missouri Basin Health Council recommends the following for consideration by the member States as a tentative guide for water pollution control activities in the Missouri Drainage Basin:
>
> 1. Toxic substances including metallic ions, phenolic compounds, oils, alkalies, and acids should be virtually eliminated from sewage effluents.
>
> 2. Removal of settleable and floating solids to prevent sludge banks, floating materials, and nuisance conditions should be required as the minimum acceptable treatment.
>
> 3. For industrial wastes similar in nature to municipal wastes, treatment should be based on the same premise as recommended for municipalities. For industrial wastes not comparable to municipal wastes, treatment should be provided as necessary to prevent deterioration of water quality for beneficial uses in the receiving stream.
>
> 4. Additional treatment over that specified in item 2 above should be provided as necessary to protect downstream water uses. Quality objectives for certain water uses are:
>
>   (a) For water serving as a source of domestic supply, raw water bacteriological quality should conform to that recommended in "Manual of Recommended Water Sanitation Practices, 1946, Public Health Bulletin # 296," pages 11-13.

---

* Action by Engineering Section, Missouri Basin Health Council on Jan. 7, 1954, reaffirmed the Guide and eliminated the qualification "tentative".

(b) 'For bathing or swimming waters, monthly arithmetical average 'most probable number' of coliform organisms should not exceed 1,000 per 100 ml. during any month of the recreation season; nor exceed this number in more than 20 percent of the samples examined during any such month; nor exceed 2,400 per 100 ml. on any day. For nonbathing or nonswimming waters, the monthly arithmetical average 'most probable number' of coliform organisms should not exceed 5,000 per 100 ml. in any month of the recreational season, nor should exceed this number in more than 20 percent of the samples examined during any such month.'

(c) For fish and aquatic life a minimum oxygen concentration of 5.0 ppm. is desirable in waters otherwise offering suitable fishery habitat, with 6.0 ppm. for trout streams.

(d) For bacteriological quality of irrigation water:

(1) Sewage used for irrigation of forage crops should be given treatment insuring a consistent reduction in coliform bacteria of not less than 90 percent.

(2) Sewage used for irrigation of human food crops should be given treatment insuring a consistent reduction (a) in suspended solids of not less than 75 %, (b) in 5 day 20°C. B.O.D. of not less than 75 % and (c) in coliform bacteria of not less than 98 percent, unless discharged into a stream where the volume of dilution water, available during the low flow periods during which irrigation diversions may occur, is at least 10 times greater than the anticipated maximum daily volume of sewage, in which case a bacterial reduction of 90 percent may be acceptable.

Provided, however, that where the time of passage from plant discharge to irrigation diversion is such as to permit the normal death rate of bacteria as evidenced by the die-away curve to provide equivalent bacterial reduction, the requirements of (1) and (2) above may be appropriately modified."

SOURCES OF POLLUTION

There are 1,073 municipalities, institutions or sanitary districts with sewerage systems in the Missouri River Basin. Table 1 indicates that sewers serve 3,955,710 persons to which may be added 2,784,250 population equivalent units of industrial waste discharging to municipal systems for a total of 6,739,960 population equivalents tributary to muncipal sewers. Municipal pollution discharged to streams of the Basin is estimated at a population equivalent of 4,891,650. The difference, 1,848,310 population equivalents, between the contributed waste and discharged waste represents that removed by treatment. This amounts to a removal of 27.4 percent of the biochemical oxygen demand of the raw wastes carried in municipal sewers as effected by treatment in 759 communities serving 70.7 percent of the sewered population. One factor most difficult to evaluate firmly is the effectiveness of operation of waste treatment plants, which varies from excellent to grossly inadequate. Data regarding sewage treatment plant capacity and operation are presented in table 2 of each Sub-Basin Section.

Table 2 lists 332 industrial outlets contributing 10,008,880 population equivalents to watercourses of the Basin. Most of the plants contributing organic wastes are associated with the processing of food and kindred products, such as sugar refineries, meat packing plants and creameries. Many of the plants produce both organic and inorganic wastes, particularly those connected with the petroleum production and processing industry. Organic wastes from this industry consist of wasted oil and phenols, while caustic material and brines make up the inorganic discharges. Other sources of inorganic waste are mining operations and the manufacture of chemicals. The wastes from mines consist of acid drainage, rock flour, coal dust, and other various substances. Wastes such as cyanides are associated with the mining and the separating of gold from ores. One hundred forty-three industrial establishments provide some degree of treatment, although only 66 are considered satisfactory. Data regarding industrial waste treatment is contained in table 3 of each Sub-Basin Section.

A comparison of the wastes discharged by industrial and municipal outlets reveals that the population equivalent of the separately discharging industrial waste is approximately twice that of the municipal waste.

Silt is an important aspect of the over-all problem of pollution in the Missouri Basin. In the main stem below the Yellowstone, and in the lower reaches of several tributaries, silt adversely influences certain water uses as fishing and recreation. Silt removal is an important although relatively uncomplicated aspect of municipal and industrial water treatment. As silt control is more logically a function of agricultural and other interests, discussions in this report are largely limited to recognition of the problem. Reservoir construction, watershed management, reforestation, soil conservation and related aspects of the Missouri Basin Land and Water Resources Development Plan may ultimately do much to alleviate the problem of silt pollution in the Basin.

Table 1. Missouri River Basin - Summary data - Municipal wastes*

Sub-Basin	Number of munici-palities with sewerage	Sewered popula-tion	Estimated population equivalent untreated wastes**	Sewered munici-palities with treatment		Percent sewered popula-tion served by treatment	Percent waste reduction by treatment	Estimated population equivalent discharged to streams
				No.	Percent			
Big Sioux	44	118,740	405,730	35	79.5	90.2	85.2	59,920
Central Missouri	66	106,670	108,720	51	77.3	69.9	47.1	57,540
Grand-Chariton	33	54,500	68,300	26	78.8	74.5	44.7	37,790
James	58	93,980	175,250	40	69.0	89.2	54.9	78,980
Kansas	171	606,600	1,088,830	125	73.1	55.4	28.4	779,650
Lower Missouri	268	1,400,430	2,899,410	174	64.9	27.4	9.8	2,615,170
Lower Platte	88	242,610	362,320	49	55.7	65.0	34.8	236,150
Missouri-Souris	81	126,880	166,510	68	84.0	66.8	31.1	114,690
Niobrara	11	9,810	12,040	8	72.7	73.2	46.7	6,610
North Platte	33	87,140	160,480	12	36.4	25.1	2.4	156,700
Osage-Gasconade	45	111,980	131,610	42	93.3	94.1	70.0	39,460
South Platte	73	714,500	898,900	58	79.4	96.3	45.8	467,210
Upper Missouri	51	132,560	134,480	37	72.6	42.5	8.8	122,670
Yellowstone	51	127,370	127,740	34	66.7	59.6	22.4	99,150
Totals	1,073	3,955,710	6,739,960	759	70.7	56.5	27.4	4,091,650

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers, or other population centers.
**Includes industrial wastes discharged into municipal sewerage systems.

Table 2. Missouri River Basin - Summary data - Industrial wastes*

Sub-Basin	Number of industries	Estimated discharged wastes population equivalent	Industries with treatment		Industries with adequate treatment or control measures	
			No.	Percent	No.	Percent
Big Sioux	6	2,650	5	83.3	3	50.0
Central Missouri	8	57,000	7	87.5	0	0.0
Grand-Chariton	5	4,880	3	60.0	1	20.0
James	14	7,060	6	42.9	4	28.6
Kansas	29	719,750	9	31.0	5	17.2
Lower Missouri	73	1,688,520	18	24.7	9	12.3
Lower Platte	24	83,190	5	20.8	4	16.7
Missouri-Souris	24	6,010	6	25.0	6	25.0
Niobrara	1	520	0	0.0	0	0.0
North Platte	22	1,916,570	6	27.3	1	4.5
Osage-Gasconade	8	5,940	3	37.5	0	0.0
South Platte	86	4,190,910	51	59.3	23	26.7
Upper Missouri	10	5,200	9	90.0	4	40.0
Yellowstone	22	1,321,600	15	68.2	6	27.3
Total	332	10,008,880	143	43.2	66	19.9

*Industries having separate outlets and discharging wastes directly to watercourse.

THE COMPREHENSIVE PROGRAM

One of the most effective and feasible steps in control of stream pollution is construction and proper operation of sewage and waste treatment facilities. Other measures should include control and prevention of silt, oil and miscellaneous pollution from whatever source. It is in the public interest for the States to sustain most favorable stream conditions and preclude occurrences of nuisances. Fundamentally, the citizens and industries of the Basin must assume their rightful obligations and provide the needed pollution control facilities.

Table 1 indicates that 314 municipalities out of 1,073 with sewerage do not provide treatment for their wastes. In addition, 299 treatment plants are inadequate as regards to capacity and 38 percent of existing treatment plants are not operated satisfactorily. Table 2 reveals that 189 of 332 industries do not provide treatment and that 54 percent of those with treatment have inadequate control facilities.

A listing of individual project needs by Sub-Basins as established by the respective State Water Pollution Control Agencies is presented in table 3. The total initial cost of required municipal and industrial waste treatment facilities excluding interceptors, maintenance, and operation is estimated at $186,000,000. Project needs are based upon reasonable use of available surface waters for ultimate removal and disposal of treated wastes and are in accordance with the tentative objectives adopted by the States as guides for their water pollution control programs.

Effective legislation, a necessary prologue to a construction program, must be brought about in several States of the Basin before lasting gains against the inroads of pollution can be expected. A background of State legislation which encourages pollution abatement is essential. An abatement program requires legislation authorizing effective control activities and funds for personnel to operate such a program.

Specific weaknesses in the legislation of the States of the Missouri Basin vary, however, there are some that are common to all. There is no provision in most legislation permitting State Water Pollution Control Agencies to enter into compacts with other States, interstate groups or with the Federal Government. Only Iowa, Kansas, Minnesota, South Dakota, and Wyoming have legislation relating pollution to all legitimate water uses. Missouri and Nebraska have virtually no legislative provisions for control and abatement of pollution. In the remaining States only pollution influencing public health is subject to abatement proceedings. No water pollution control agency in the Basin has statutory authority for the development of a comprehensive program for the control and abatement of water pollution. There is generally a lack of legislation which would establish minimum standards of operation of treatment works. This type of legislation is important as an instrument for obtaining better use of treatment works once they are constructed. Legislation should be broadened to insure abatement of pollution when and where it may be deleterious to legitimate water uses and to the public interest. The influence of a strong body of law is a powerful one, even though the enforcement machinery created by it may seldom be called upon to function.

Adequate staffing of technical personnel in State Health Departments is essential. Present key personnel are experienced and capable but generally can not handle unaided the work load throughout their respective States. More support for water pollution control activities by State governments will improve this situation.

It is also important that the general public be made aware of the needs for pollution abatement. Such public understanding is necessary for the enforcement of laws and for the financing of abatement works. Promotional work must be supported by studies, investigations and hearings.

Sewage treatment needs, as carried in this report, have been established by the State Water Pollution Control Agency having jurisdiction. They are based upon numerous factors, including the water quality objectives stated previously, dilution water currently available, and existing water uses. Where water resource development programs permit flow regulation, the minimum desirable flows compatible with public health and proper stream sanitation have, in many instances, been established and are contained in published Sub-Basin reports (see page 1). These Sub-Basin reports were prepared in cooperation with the development agencies, and were reviewed in draft form by all agencies participating in the development program. Minimum desirable flows as contained in the Sub-Basin reports are not repeated in this document. For the most part they are comparable to or less than normally expected low flows prevailing prior to development. The expected low flow frequencies of many stream reaches are presented in table 1 of each Sub-Basin section.

As tabulated in table 3, municipal needs are for 319 new plants, 146 replacements, 82 additions and 96 enlargements. Industrial needs are as follows: 172 new plants, 38 replacements, 26 additions, and 14 enlargements. Thus are designated 643 municipal and 250 industrial project needs for a total of 893 for the Missouri River Drainage Basin.

Table 5. Missouri River Basin - Project List - Municipalities and industries needing improvements for abatement of pollution

BIG SIOUX RIVER SUB-BASIN

State Community Industry	Project needs	State Community Industry	Project needs
Iowa		**South Dakota**	
Akron	New plant (Primary)	Arlington	Addition (Secondary)
Ashton	New plant (Secondary)	Brookings	Replace (Secondary)
Doon	Addition (Secondary)	Bryant	Addition (Secondary)
George	Replace (Secondary)	Canton	New plant (Secondary)
Hawarden	New plant (Primary)	Clear Lake	Addition (Secondary)
Hull	Replace (Secondary)	Garretson	New plant (Secondary)
Rock Rapids	New plant (Secondary)[a]	Hartford	Addition (Secondary)
Rock Valley	Enlarge (Secondary)	Hudson	New plant (Primary)
Sibley	Enlarge (Secondary)	Lake Preston	Addition (Secondary)
		Madison	Addition (Secondary)
Minnesota		Sioux Falls	Enlarge (Secondary)
Adrian	Addition (Secondary)	Rendering Works	Addition (Secondary)
Jasper		Watertown	Enlarge (Secondary)
Jasper Creamery & Meat Market	New plant or other control measures	Abattoir	New plant or other control measures
Lake Benton	Addition (Secondary)	Webster	Enlargement (Secondary)
Lake Wilson	New plant (Secondary)		
Luverne	New plant (Secondary)		
Pipestone	Enlarge (Secondary)		

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[a] Treatment units under construction.

CENTRAL MISSOURI RIVER SUB-BASIN

State Community Industry	Project needs	State Community Industry	Project needs
Nebraska		**South Dakota** (cont.)	
Chadron	Replace (Primary)	Mobridge	New plant (Primary)
Crawford	Enlarge (Secondary)	Newell	Replace (Primary)
		Onida	Enlarge (Primary)
North Dakota		Philip	Replace (Primary)
[illegible]	Enlarge (Primary)	Pierre	New plant (Primary)
Hettinger	Replace (Secondary)	Pierre—Indian School	New plant (Primary)
		Presho	Replace (Secondary)
South Dakota		Spearfish	Enlarge (Secondary)
Avon	New plant (Secondary)	Timber Lake	Enlarge (Primary)
Belle Fourche	New plant (Secondary)	Wagner	Enlarge (Primary)
U & I Sugar Refinery	Enlarge & addition (Secondary)[a]		
Bonesteel	Enlarge (Primary)	**Wyoming**	
Burke	Addition (Secondary)	Gillette	Replace (Primary)
Chamberlain	New plant (Primary)	Moorcroft	Enlarge (Primary)
Cheyenne—Indian Agcy.	New plant (Primary)	Newcastle	New plant (Secondary)
Deadwood	New plant (Primary)	[illegible] Oil Refinery	Enlarge (Primary)[b]
Edgemont	New plant (Secondary)	[illegible] Oil Refinery	Enlarge (Primary)[b]
Faith	Enlarge (Secondary)	Wyoming Gas & Oil Co.	Enlarge (Primary)
Ft. Pierre	New plant (Primary)	Niobrara County	
Ft. Thompson—Indian Agency	New plant (Primary)	Lance Creek Oil Field	Addition (Primary)[b]
Geddes	New plant (Secondary)	Osage	
Gettysburg	Enlarge (Primary)	[illegible] & [illegible] Oil Refinery	Addition (Primary)[b]
Herrick	Replace (Secondary)	Sundance	
Kimball	Replace (Primary)	Crook County Oil Refinery	Enlarge (Primary)[b]
Lake Andes	Replace (Secondary)	Upton	Enlarge (Primary)
Lead	New plant (Primary)		

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[a] Or other adequate control measures.

[b] Oil-water separation.

GRAND-CHARITON RIVER SUB-BASIN

State Community Industry	Project needs	State Community Industry	Project needs
Iowa		**Missouri** (cont.)	
Afton	Replace (Secondary)	Grant City	Replace (Secondary)
Afton Creamery	Replace (Secondary)[a]	Hamilton	Enlarge (Secondary)
Allerton	New plant (Secondary)	Laclede	
Milk Plant	New plant (Secondary)[a]	Poultry Packing Plant	Replace (Secondary)[c]
Centerville, S.E. Plant	Addition (Secondary)	Lathrop	Enlarge (Secondary)
Centerville, West Plant	Addition (Secondary)	Linneus	Enlarge (Secondary)
Chariton, S.W. Plant	Replace (Secondary)	Maryville, East Plant	Addition (Secondary)
Corydon	Replace (Secondary)	Maryville, South Plant	Addition (Secondary)
Greenfield	Enlarge (Secondary)	Milan	Addition (Secondary)
Humeston	Enlarge (Secondary)	[illegible], East Plant	Addition (Secondary)
Lenox	Replace (Secondary)	[illegible]	New plant (Secondary)
Mount Ayr[b]	Replace (Secondary)	[illegible]	Enlarge (Secondary)
		[illegible], North Plant	Addition (Secondary)
Missouri		[illegible], South Plant	Addition (Secondary)
Bethany	New plant (Primary)	[illegible]	New plant (Secondary)
Bucklin		[illegible]	New plant (Secondary)
Poultry Packing Plant	New plant (Secondary)[a]	Unionville, North Plant	Addition (Secondary)
Cameron	Enlarge (Secondary)	Unionville, South Plant	Addition (Secondary)
Chillicothe	New plant (Secondary)		
Gallatin	New plant (Primary)		

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[a] Or other adequate control measures.

[b] Information is combined for four existing treatment plants.

[c] Information is combined for two existing treatment plants.

JAMES RIVER SUB-BASIN

State Community Industry	Project needs	State Community Industry	Project needs
North Dakota		**South Dakota** (cont.)	
[illegible]	Addition (Secondary)	Faulkton	New plant (Secondary)
Ellendale	Addition (Secondary)	Frankfort	New plant (Primary)
Jamestown	Replace (Secondary)[b]	Frederick	New plant (Secondary)
Railroad Shops	New plant (Primary)[b]	Groton	New plant (Secondary)
[illegible] Co.	New plant (Primary)[b]	Huron	Enlarge (Secondary)[b]
LaMoure	New plant (Secondary)	[illegible] Packing Co.	New plant (Secondary)[b]
New Rockford	Replace (Secondary)	Iroquois	Addition (Secondary)
Oakes	New plant (Secondary)	Leola	Replace (Secondary)
		Lesterville	New plant (Secondary)
South Dakota		Menno	Addition (Secondary)
Aberdeen	Addition (Secondary)[a]	Mitchell	Addition (Secondary)[c]
[illegible] Packing Co.	New plant (Secondary)[b]	Mitchell Packing Co.	New plant (Secondary)[b]
S.D. Packing Co.	New plant (Secondary)[b]	[illegible] Meat Co.	New plant (Secondary)[b]
[illegible] Produce Co.	New plant (Secondary)[b]	Mt. Vernon	New plant (Primary)
Alexandria	Addition (Secondary)	Olivet	New plant (Secondary)
Andover	New plant (Primary)	Parkston	Addition (Secondary)
Artesian	New plant (Secondary)	Plankinton	Addition (Secondary)
Ashton	New plant (Primary)	Redfield	Addition (Secondary)
Bridgewater	New plant (Secondary)	Scotland	Addition (Secondary)
Britton	Addition (Secondary)	Spencer	Addition (Secondary)
Carthage	New plant (Secondary)	Wessington	Replace (Secondary)
Clark		Wessington Springs	Addition (Secondary)
Clark Dairy Products Co.	Replace (Secondary)[b]	Wolsey	New plant (Secondary)
Doland	New plant (Secondary)	Woonsocket	New plant (Secondary)
Emery	Addition (Secondary)		
[illegible]			
[illegible] Dairy Products Co.	Replace (Secondary)[b]		

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[a] A high degree of secondary or tertiary treatment required to prevent pollution.

[b] Or other equivalent pollution control measures.

[c] To include units which will enable treatment of industrial wastes.

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Table 1. [illegible] - Needs for elimination of pollution (cont.)

[illegible] RIVER SUB-BASIN

Locality Community Industry	Project needs
Colorado	
[illegible]	Enlarge (Primary)
Cheyenne Wells	Replace (Secondary)
[illegible]	Replace (Primary)
[illegible]	Enlarge (Primary)
[illegible]	Replace (Primary)
Kansas	
[illegible]	Enlarge (Primary)
[illegible]	Addition (Secondary)a
[illegible]	Replace (Secondary)
[illegible]	Replace (Secondary)
[illegible]	Replace (Secondary)
[illegible]	New plant (Primary)
[illegible]	New plant (Primary)
[illegible] Springs	New plant (Primary)
[illegible]	Replace (Primary)a
E. B. Kite Sausage Co.	New plant (Primary)a
[illegible]	New plant (Primary)
Clay Center	New plant (Primary)
[illegible]	Enlarge (Primary)
[illegible]	Enlarge (Primary)
[illegible]	Enlarge (Secondary)
[illegible]	New plant (Primary)a
De Soto	New plant (Primary)
[illegible]	New plant (Secondary)
[illegible]	
[illegible]	New plant (Secondary)a
[illegible]	New plant (Primary)
[illegible]	New plant (Primary)
[illegible] Air Base	Addition (Secondary)
[illegible]	New plant (Secondary)
[illegible] Plant	New plant or other control measuresa
[illegible]	New plant (Primary)
[illegible]	Enlarge (Secondary)a
[illegible]	New plant (Primary)
[illegible]	Enlarge (Secondary)
[illegible]	Replace (Secondary)
[illegible]	Addition (Secondary)
[illegible] City	New plant (Primary)a
Kansas City	New plant (Primary)
[illegible] Valley [illegible] Co.	New plants or connect to Kansas City, Kansas, system
[illegible] & Co.	
[illegible] Laboratory	
[illegible] & [illegible]	
[illegible]	
[illegible] Cold Storage	
[illegible] & Co.	
[illegible] & Co.	
[illegible] Co.	
[illegible] Railroad Co.	
Union Pacific Railroad Co.	
[illegible] Refining Co.	
Kansas City, Mo.	New plant (Primary)
[illegible]	New plant (Primary)
[illegible] Paper Mill	New plant (Primary)a
[illegible]	Replace (Secondary)
[illegible]	New plant (Primary)
[illegible] Laboratory [illegible] Plant	Connect to City of [illegible]

Locality Community Industry	Project needs
Kansas (cont.)	
[illegible]	New plant (Primary)
[illegible]	New plant (Primary)
[illegible]	New plant (Primary)
[illegible] Township Sanitary Dist.	Enlarge (Secondary)a
[illegible]	
[illegible] Ice & [illegible] Co.	Replace (Primary)a
[illegible]	New plant (Primary)a
[illegible]	Replace (Secondary)
[illegible]	Replace (Secondary)
[illegible]	New plant (Secondary)
[illegible]	Enlarge (Secondary)a
[illegible]	New plant (Primary)
Sharon Springs	Replace (Secondary)
[illegible]	New plant (Primary)
St. Marys	Replace (Primary)
St. Marys College	Replace (Primary)
[illegible]	
[illegible] Ordnance	Replace (Secondary)a
[illegible]	Enlarge (Secondary)a
[illegible]	Replace (Secondary)a
Franklin Ice Cream Co.	Replace (Secondary)a
[illegible]	
Grade and High Schools	New plant (Primary)
Valley Falls	New plant (Secondary)a
Mitchell Sausage Factory	New plant (Secondary)
[illegible]	New plant (Primary)
[illegible]	New plant (Primary)
Waterville	New plant (Primary)
Wilson	Enlarge (Secondary)a
Nebraska	
[illegible]	New plant (Primary)
[illegible]	
[illegible]	New plant (Primary)a
Aurora	Enlarge (Secondary)
[illegible]	New plant (Secondary)
[illegible]	Replace (Secondary)
[illegible]	Replace (Primary)
[illegible]	Enlarge (Secondary)
[illegible]	New plant (Primary)
[illegible]	Enlarge (Secondary)
[illegible]	New plant (Primary)
[illegible]	New plant (Primary)
[illegible]	Enlarge (Secondary)
[illegible]	New plant (Primary)
Milford	New plant (Primary)
[illegible]	New plant (Secondary)
[illegible]	New plant (Primary)
Red Cloud	New plant (Primary)
[illegible]	New plant (Primary)
[illegible]	New plant (Secondary)
Superior	New plant (Primary)
[illegible]	New plant (Primary)
[illegible]	New plant (Primary)
Wilber	New plant (Primary)

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a Treatment works under construction.
b Or other equivalent pollution control measures.
c [illegible]
d [illegible] by the State water pollution control agency having jurisdiction.
e [illegible] completed since reporting date.

[illegible] RIVER SUB-BASIN

Locality Community Industry	Project needs
Iowa	
[illegible]	Replace (Secondary)
[illegible] Plant	New plant (Secondary)
[illegible]	New plant (Secondary)
[illegible]	Replace (Secondary)
[illegible] Park [illegible] [illegible] [illegible] Lake	Enlarge (Secondary)
[illegible]	New plant (Secondary)
[illegible]	
[illegible] Plant	New plant (Secondary)
[illegible]	Replace (Secondary)
[illegible]	New plant (Secondary)
[illegible] Creek	New plant (Secondary)
[illegible]	Enlarge (Secondary)
[illegible]	Enlarge (Secondary)
[illegible]	New plant (Secondary)
[illegible]	New plant (Secondary)
[illegible]	New plant (Primary)
[illegible] Lake	New plant (Secondary)
[illegible]	New plant (Secondary)
State Hospital	
[illegible]	Replace (Secondary)
[illegible] Plant	Addition (Secondary)
[illegible]	New plant (Primary)
Council Bluffs	New plant (Primary)
[illegible] Plant	New plant (Secondary)
[illegible]	New plant (Secondary)
[illegible]	New plant (Secondary)
[illegible] City	New plant (Secondary)
[illegible]	Replace (Secondary)
[illegible]	New plant (Secondary)
[illegible]	New plant (Secondary)
[illegible]	Addition (Secondary)
[illegible]	Addition (Secondary)
[illegible]	New plant (Secondary)
[illegible]	
[illegible] Plant	New plant (Secondary)
[illegible]	New plant (Secondary)
[illegible] Plant	New plant (Secondary)

Locality Community Industry	Project needs
Iowa (cont.)	
[illegible]	New plant (Secondary)
[illegible]	Addition (Secondary)
[illegible]	New plant (Primary)
[illegible]	Replace (Secondary)
[illegible]	
[illegible]	Replace (Secondary)
Iowa School for Deaf	New plant (Secondary)
[illegible]	Replace (Secondary)
Lake Park	Replace (Secondary)
[illegible]	New plant (Secondary)
[illegible] Plant	New plant (Secondary)
[illegible]	Replace (Secondary)
[illegible] Grove	New plant (Secondary)
Logan	New plant (Primary)
[illegible]	New plant (Secondary)
[illegible]	Replace (Secondary)
[illegible]	Replace (Secondary)
[illegible]	Replace (Secondary)
[illegible]	Addition (Secondary)
[illegible]	New plant (Primary)
Milford	Replace (Secondary)
[illegible] Valley	New plant (Secondary)
[illegible]	Replace (Secondary)
[illegible]	Addition (Secondary)
[illegible]	New plant (Secondary)
[illegible] Plant	New plant (Secondary)
[illegible]	Addition (Secondary)
[illegible]	Replace (Secondary)
Orange City	Addition (Secondary)
[illegible]	New plant (Secondary)
[illegible]	Replace (Secondary)
[illegible]	Replace (Secondary)
[illegible]	
[illegible] Plant	New plant (Secondary)
Red Oak	New plant (Secondary)
[illegible]	Addition (Secondary)
[illegible]	Replace (Secondary)
[illegible]	Replace (Secondary)
[illegible]	New plant (Secondary)
[illegible]	New plant (Secondary)
[illegible]	Enlarge (Secondary)

Table 5. Missouri River Basin - Project List - Municipalities and industries needing improvements for abatement of pollution (cont.)

LOWER MISSOURI RIVER SUB-BASIN (cont.)

State Community Industry	Project needs
Iowa (cont.)	
Sioux City	New plant (Primary)
Albertson & Co.	New plant (Primary)
Allied Laboratories, Inc.	New plant (Primary)
American Serum Co.	New plant (Primary)
Armour & Co.	New plant (Primary)
Cudahy Co.	New plant (Primary)
Swift Co.	New plant (Primary)
[illegible] & Produce Co.	New plant (Primary)
[illegible] Packing Co.	New plant (Primary)
Sanitary Rendering Co.	New plant (Primary)
Smith Packing Co.	New plant (Primary)
Swift D & P	New plant (Primary)
T & W Packing Co.	New plant (Primary)
Tri-State Produce Co.	New plant (Primary)
Sioux Rapids	New plant (Secondary)
Stanton	Replace (Secondary)
Sutherland	Replace (Secondary)
Tabor	Replace (Secondary)
Vail	New plant (Secondary)
Villisca	New plant (Secondary)
Wall Lake	Replace (Secondary)
Westside	Addition (Secondary)
Woodbine	New plant (Secondary)
Kansas	
Atchison	New plant (Primary)
Kansas City	New plant (Primary)
Lansing	
State Penitentiary	New plant (Secondary)[b]
Leavenworth	New plant (Primary)
Federal Penitentiary	New plant (Primary)
Ft. Leavenworth	New plant (Primary)
National Battery Co.	New plant (Primary)
Morrill	Addition (Secondary)
Robinson	Enlarge (Secondary)
Seneca	Replace (Secondary)
Wadsworth - Veterans Hospital	New plant (Primary)
Wathena	Enlarge (Secondary)
Missouri	
Algoa	
State Reformatory	New plant (Primary)
Alma	
Alma Creamery	New plant (Secondary)
Amazonia	Replace (Secondary)
Blue Springs	
Adams Dairy	Enlarge (Secondary)
Boone and Callaway Counties	
Acid Mine Wastes	New plants
Boonville	New plant (Primary)
State Boys Home	New plant (Primary)
Bridgeport	Addition (Secondary)
Burlington Junction	New plant (Primary)
California (W.S.Plant)	Replace (Secondary)
California (E.S.Plant)	Replace (Secondary)
California (S.E.Plant)	Replace (Secondary)
[illegible] Mills	Replace (Secondary)
Carrollton	New plant (Secondary)
Chamois	New plant (Primary)
Columbia	Enlarge (Secondary)
Dawn	
Dawn Creamery	Replace (Secondary)
Excelsior Springs	Enlarge (Secondary)
Fairfax	New plant (Primary)
Fayette (N. Plant)	Replace (Secondary)
Fayette (S. Plant)	Replace (Secondary)
New Franklin	New plant (Primary)
Florissant	Addition (Secondary)
Friendly Homes Subdivision Jackson County	Enlarge (Secondary)
Fulton	Enlarge (Secondary)
Glasgow	New plant (Primary)
Hermann	New plant (Primary)
Higginsville (N. Plant)	Replace (Secondary)
Higginsville (S. Plant)	Replace (Secondary)
Buck's Slaughterhouse	New plant (Secondary)
[illegible] Custom Slaughtering	New plant (Secondary)
Holden	Replace (Secondary)
Independence (N. Plant)	Replace (Secondary)
Independence (N. side)	New plant (Primary)
Jackson County S.D. #1	
Outfall #1	New plant (Primary)
Outfall #2	New plant (Primary)
Jefferson City	New plant (Primary)
Kansas City	New plant (Primary)
American Asphalt Roofing Co.	New plant (Secondary)
American Creosote Co.	New plant (Secondary)
Black, Sivalls & Bryson	New plant (Secondary)
Chevrolet Assembly Plant	New plant (Secondary)
Fisher Body Co.	New plant (Secondary)
Ford Motor Assembly Plant	New plant (Secondary)
[illegible] Corporation	New plant (Secondary)
Schenley Distributors, Inc.	New plant (Primary)
Sheffield Steel Corporation	New plant (Secondary)
Union Wire Rope Corporation	New plant (Secondary)
Vendo Company	New plant (Secondary)
Westinghouse and Bendix	Enlarge (Secondary)
Lake Tapawingo	New plant (Secondary)
Leavenworth Federal Penitentiary Farm	New plant (Primary)
Leawood (Kansas)	Enlarge (Secondary)
Lees Summit ([illegible])	Replace (Secondary)
Lees Summit ([illegible])	Replace (Secondary)
Lees Summit ([illegible])	Replace (Secondary)
Lees Summit ([illegible])	Replace (Secondary)
Missouri (cont.)	
Lees Summit	
Rice's Sausage Co.	New plant (Secondary)
Oldham Farm Sausage	Replace (Secondary)
Lexington	New plant (Primary)
Liberty	New plant (Secondary)
Maitland	New plant (Primary)
Maryville	New plant (Secondary)
Montgomery City	Addition (Secondary)
Mound City	New plant (Primary)
New Franklin	New plant (Secondary)
New Haven	New plant (Primary)
Norborne	Replace (Secondary)
North Kansas City	New plant (Primary)
Corn Products Refining Co.	Addition[a]
Odessa	Replace (Secondary)
Plattsburg No. 1	Replace (Secondary)
Plattsburg No. 2	Replace (Secondary)
Ravenwood	
Ravenwood Co-Op Creamery	New plant (Secondary)
Richmond	Replace (Secondary)
Rockport	New plant (Primary)
St. Ann's Village	Enlarge (Secondary)
St. Charles	New plant (Primary)
St. John's	Enlarge (Secondary)
St. Joseph	New plant (Primary)
Anchor Serum Co.	New plant (Primary)
Armour & Co.	New plant (Primary)
Consumers Co-Op.	New plant (Primary)
[illegible] Produce Co.	New plant (Primary)
Swift & Co.	New plant (Primary)
St. Louis County	
Ford Motor Co.	New plant (Secondary)
McDonnell Aircraft	New plant (Secondary)
Sedalia	
Ideal Packing Co.	Replace (Secondary)
[illegible] Packing Co.	Replace (Secondary)
Smithville	Addition (Secondary)
Sugar Creek	New plant (Primary)
Tarkio	New plant (Primary)
Unity Farm, Jackson County	Addition (Secondary)
Warrensburg (W. outfall)	New plant (Secondary)
Warrensburg (E. plant)	Replace (Secondary)
Washington	New plant (Primary)
Waverly	New plant (Primary)
Wellsville	Replace (Secondary)
Weston	New plant (Primary)
McCormick Distillery	New plant (Primary)
Nebraska	
Auburn	New plant (Secondary)
Bellevue	New plant (Primary)
Blair	New plant (Secondary)
Bloomfield	Addition (Secondary)
Crofton	Enlarge (Secondary)
Elkhorn	Replace (Secondary)
Falls City	New plant (Secondary)
Humboldt	New plant (Secondary)
Kennard	New plant (Secondary)
Nebraska City	New plant (Primary)
Niobrara	New plant (Primary)
[illegible]	Enlarge (Secondary)
Omaha	New plant (Primary)
Greater Omaha Packing Co.	New plant (Primary)
Quaker Oats Furfural Plant	New plant (Primary)
South Omaha Packers	New plant (Primary)
Papillion	New plant (Secondary)
Plattsmouth	New plant (Primary)
Ponca	New plant (Secondary)
Ralston	New plant (Secondary)
South Sioux City	New plant (Primary)
Syracuse	New plant (Secondary)
Tecumseh	New plant (Secondary)
Walthill	New plant (Secondary)
Winnebago	New plant (Secondary)
South Dakota	
Beresford	Replace (Secondary)
Elk Point	New plant (Primary)
Freeman	Addition (Secondary)
Salem	Replace (Secondary)
Springfield	New plant (Primary)
Tyndall	Replace (Secondary)
Vermillion	New plant (Secondary)
Yankton	New plant (Primary)
New England Distillery Co.	New plant (Primary

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[a] Internal "bottle-up" waste recovery process reduces waste; additional treatment methods under consideration.

[b] Treatment units under construction.

Table 5. Missouri River Basin - Project List - Municipalities and industries needing improvements for abatement of pollution (cont.)

LOWER PLATTE RIVER SUB-BASIN

State Community Industry	Project needs	State Community Industry	Project needs
Nebraska		Nebraska (cont.)	
Albion	New plant (Primary)	Lindsay	Addition (Secondary)
Ashland	New plant (Primary)	Louisville	New plant (Primary)
Atkinson	New plant (Primary)	Loup City	New plant (Primary)
Battle Creek		Lyons	New plant (Secondary)
Co-Op Creamery	New plant (Primary)[a]	Madison	Replace (Secondary)
Beemer	New plant (Primary)	Neligh	New plant (Primary)
Broken Bow	Enlarge (Secondary)	Newman Grove	Replace (Secondary)
Burwell	New plant (Secondary)	Norfolk	New plant (Secondary)
City Market Slaughter House	New plant (Secondary)[a]	Norfolk Rendering Co.	New plant (Secondary)[a]
Cedar Rapids	New plant (Primary)	Hansen Packing Co.	New plant (Secondary)[a]
Clarkson	Addition (Secondary)	Oakland	New plant (Secondary)
Columbus	Replace (Primary)	O'Neill	New plant (Secondary)
Columbus Rendering Co.	New plant (Primary)[a]	Ord	New plant (Primary)
Smith's Dairy	New plant (Primary)[a]	Ord Slaughter House	New plant (Primary)[a]
Cozad	New plant (Secondary)	Pender	New plant (Secondary)
Dannebrog		Independent Rendering Co.	New plant (Secondary)[a]
Greenland Creamery	New plant (Secondary)[a]	Pierce	New plant (Primary)
Dodge	Replace (Secondary)	Pilger	New plant (Primary)
Fremont	New plant (Primary)	Ravenna	New plant (Primary)
Fullerton	New plant (Primary)	St. Edward	New plant (Primary)
Genoa	New plant (Primary)	St. Paul	New plant (Primary)
Gibbon	Replace (Primary)	Schuyler	New plant (Secondary)
Gothenburg	New plant (Primary)	Scribner	New plant (Primary)
Grand Island		Silver Creek	New plant (Secondary)
American Crystal Sugar Refinery	New plant (Secondary)[a]	Snyder	Addition (Secondary)
Hooper	New plant (Primary)	Spalding	New plant (Primary)
Howells	Addition (Secondary)	Stanton	New plant (Primary)
Humphrey	Replace (Secondary)	Thedford	New plant (Primary)
Kearney	New plant (Secondary)	Tilden	Replace (Primary)
Kearney Packing Co.	New plant (Secondary)[a]	Wahoo	New plant (Secondary)
Moore Slaughter House	New plant (Secondary)[a]	Wakefield	New plant (Secondary)
Shirley Slaughter House	New plant (Secondary)[a]	Waterloo	
Laurel	Replace (Primary)	Roberts Dairy	Addition (Secondary)[a]
Leigh	Addition (Secondary)	Wayne	New plant (Secondary)
Lexington	Replace (Primary)	Wayne Rendering Co.	New plant (Secondary)[a]
Lexington Locker Plant	New plant (Primary)[a]	Weston	New plant (Primary)
Lexington Rendering Co.	New plant (Primary)[a]	West Point	New plant (Primary)
French Bros. Slaughter House	New plant (Primary)[a]	West Point Rendering Co.	New plant (Primary)[a]
Lincoln	Enlarge (Secondary)	Winside	New plant (Secondary)
Cushman Scooter Co.	New plant (Secondary)[a]	Wisner	New plant (Primary)

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[a] Or other appropriate control measures.

MISSOURI-SOURIS RIVER SUB-BASIN

State Community Industry	Project needs	State Community Industry	Project needs
Missouri River Sub-Basin		Missouri River Sub-Basin (cont.)	
Montana		North Dakota (cont.)	
Circle	Replace (Primary)	Riverdale	New plant (Primary)
Medicine Lake	Enlarge (Primary)	Stanley	Addition (Secondary)
Plentywood	New plant (Secondary)	Stanton	New plant (Primary)
Scobey	Enlarge (Primary)	Washburn	New plant (Primary)
Wolf Point	Replace (Primary)	Williston	New plant (Primary)
North Dakota		Souris River Sub-Basin	
Beach	Replace (Secondary)[a]	North Dakota	
Belfield		Crosby	Replace (Secondary)
Andy's Coal Mine	New plant (Secondary)[b]	Drake	Replace (Secondary)
Beulah	Replace (Primary)	Kenmare	New plant (Secondary)
Bismarck	New plant (Primary)	Minot	
Bismarck Abattoir	New plant (Primary)[b]	Hutmore Sausage Co.	New plant (Secondary)[c]
Dickinson	Addition (Secondary)	Mohall	Replace (Secondary)
Dickinson Coal Mine Co.	New plant (Secondary)[b]	Rolla	Replace (Secondary)
Queen City Packing Co.	New plant (Secondary)[b]	Towner	New plant (Secondary)
Ft. Lincoln	New plant (Secondary)	Velva	New plant (Secondary)
Linton		Jos Point Co.	New plant (Secondary)[b]
Linton Slaughterhouse	New plant (Primary)[b]	Truax Mining Co.	New plant (Secondary)[b]
Mandan	New plant (Secondary)	Westhope	New plant (Secondary)
Russel Miller Milling Co.	New plant (Primary)[c]		
Mandan—State Training School	New plant (Primary)	Devils Lake Area	
Marmarth	Replace (Primary)	North Dakota	
Mott	Replace (Secondary)	Cando	Replace (Secondary)
New England	Replace (Secondary)	Devils Lake	Replace (Secondary)

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[a] Under construction.
[b] Or other equivalent pollution control measures.
[c] Or connect to municipal sewer system.

NIOBRARA RIVER SUB-BASIN

State Community Industry	Project needs	State Community Industry	Project needs
Nebraska			
Gordon	Enlarge (Secondary)	South Dakota	
Hay Springs	Addition (Secondary)	Gregory	Addition (Secondary)
Rushville	Enlarge (Secondary)		
Spencer	New plant (Secondary)	Wyoming	
Valentine	New plant (Primary)	Manville	New plant (Primary)
Verdigre			
Verdigre Creamery and Locker Plant	New plant (Secondary)		

NORTH PLATTE RIVER SUB-BASIN

State Community Industry	Project needs	State Community Industry	Project needs
Nebraska		Nebraska (cont.)	
Bayard	New plant (Primary)	Mitchell	New plant (Secondary)
Great Western Sugar Refinery	New plant (Secondary)[a]	Great Western Sugar Refinery	New plant (Secondary)[a]
Bridgeport	New plant (Primary)	Morrill	New plant (Primary)
Broadwater	New plant (Primary)	North Platte	New plant (Secondary)
Gering	Replace (Secondary)	Flicker Packing Co.	New plant (Secondary)[a]
Great Western Sugar Refinery	New plant (Secondary)[a]	North Platte Stockyards	New plant (Secondary)[a]
Miller Packing Co.	New plant (Secondary)[a]	Sixth Street Market	New plant (Secondary)[a]
U.P. Roundhouse	New plant (Secondary)[a]	Oshkosh	New plant (Primary)
Henry	New plant (Primary)	Scottsbluff	New plant (Secondary)
Platte Valley Poultry Marketing	New plant (Primary)[a]	Co-Op Oil Refinery	Enlarge (Secondary)[a]
Lyman	New plant (Primary)	Flicker Packing Co.	New plant (Secondary)[a]
Melbeta	Replace (Primary)	Great Western Sugar Refinery	New plant (Secondary)[a]
Minatare	New plant (Primary)	H. & B. Packing Co.	New plant (Secondary)[a]
		Branch Packing Co.	New plant (Secondary)[a]
		Idlewild Dairy	New plant (Secondary)[a]
		Scottsbluff Rendering Plant	New plant (Secondary)[a]

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[a] Or other equivalent pollution control measures

Table 3. Missouri River Basin - Project List - Municipalities and industries needing improvements for abatement of pollution (cont.)

NORTH PLATTE RIVER SUB-BASIN (Cont.)

State Community Industry	Project needs
Wyoming	
Casper	New plant (Secondary)
Socony Vacuum Oil Refinery	Enlarge (Secondary)[a]
Standard Oil Refinery	Enlarge (Secondary)[a]
Texas Oil Refinery	Enlarge (Secondary)[a]
Douglas	New plant (Secondary)
Evansville	New plant (Primary)
Glenrock	New plant (Secondary)
Continental Oil Refinery	Enlarge (Secondary)[a]
Guernsey	New plant (Primary)
Wyoming (cont.)	
Laramie	Replace (Secondary)
Lingle	New plant (Primary)
Medicine Bow	New plant (Primary)
Rawlins	New plant (Primary)
Rock River	New plant (Primary)
Sinclair	Enlarge (Primary)
Torrington	New plant (Primary)
Holly Sugar Refinery	New plant (Secondary)[a]
Wheatland	Replace (Primary)

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[a] Or other equivalent pollution control measures.

OSAGE (MARAIS DES CYGNES) - GASCONADE RIVER SUB-BASINS

State Community Industry	Project needs
Kansas	
Fort Scott	Addition (Secondary)
Garnett	Enlarge (Secondary)
LaCygne	Addition (Secondary)
Lyndon	Replace (Secondary)
Paola	Enlarge (Secondary)
Pleasanton	Replace (Secondary)
Missouri	
Belton	Enlarge (Secondary)
Bolivar	Enlarge (Secondary)
Buffalo	
Cheese Plant	New plant (Secondary)[a]
Butler	Enlarge (Secondary)
Camdenton[b]	Replace (Secondary)
Clinton	Enlarge (Secondary)
Eldorado Springs	New plant (Secondary)
Greenfield[b]	Addition (Secondary)
Missouri (cont.)	
Hartville	
Cheese Plant	Enlarge (Secondary)[a]
Harrisonville	Replace (Secondary)
Humansville	
Cheese Plant	Replace (Secondary)[a]
Mansfield	Enlarge (Secondary)
Kraft Food Co.	Replace (Secondary)[a]
Nevada	New plant (Secondary)
State Hospital No. 3	New plant (Secondary)
Osceola	Replace (Secondary)
Cheese Plant	New plant (Secondary)[a]
Pleasant Hill	Replace (Secondary)
Polk	
Cannery	New plant (Secondary)[a]
Rockville	
Cheese Plant	New plant (Secondary)[a]
Stockton	Replace (Secondary)
Cheese Plant	New plant (Secondary)[a]
Warsaw	Replace (Secondary)

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[a] Or other equivalent pollution control measures.

[b] Information is combined for two existing treatment plants.

SOUTH PLATTE RIVER SUB-BASIN

State Community Industry	Project needs
Colorado	
Arvada (S.D. #1)	Addition (Secondary)[a]
Aurora (S.D. #27)	Replace (Secondary)[a]
Baker (S.D. #22)	Addition (Secondary)
Berthoud	Addition (Secondary)[b]
Boulder	Enlarge and addition (Secondary)
Brighton (S.D. #24)	Addition (Secondary)[b]
G-W Sugar Refinery	Addition (Secondary)
Kuner-Empson Cannery	New plant (Secondary)
Brush	Addition (Secondary)
G-W Sugar Refinery	New plant (Secondary)
Buckley Field	Addition[c]
Bureau of Reclamation Camp	Addition (Secondary)[b]
Castle Rock	Replace (Secondary)
Clear Creek (S.D. #2)	New plant (Secondary)[a]
Dacono	
McNeil Coal Co. Sterling Mine	New plant (Adequate control measures)
Shamrock Coal Co. Shamrock Mine	New plant (Adequate control measures)
Deer Trail	New plant (Secondary)
Denver	Addition (Secondary)[a]
Altberger Packing Co.	Replace (Secondary)
Bay Petroleum Co.	Addition (Secondary)
Brookridge Farms Dairy	Replace (Secondary)
Capitol Rendering Co.	Replace (Secondary)
Central Fibres Products Co.	New plant (Secondary)
City Park Farm Dairy	New plant (Secondary)
C.B.&Q.R.R. Shops	Replace (Primary)
Colorado & Southern R.R.Shops	Replace (Primary)
Continental Oil Co.	Addition (Secondary)
Dorffler Horse Packing Co.	Replace (Secondary)
Garden Farms Dairy	New plant (Secondary)
Litvak Meat Co.	Replace (Secondary)
National Food Stores, Inc.	Replace (Secondary)
Rio Grande R.R. Shops	Replace (Primary)
Swett Packing Co.	New plant (Secondary)
Santa Fe R.R. Shops	Replace (Primary)
Eaton	Addition (Secondary)
G-W Sugar Refinery	Addition (Secondary)
Erie	
Clayton Coal Co. Lincoln Mine	New plant (Adequate control measures)
Erie Coal Co. Erie Strip Mine	New plant (Adequate control measures)
Imperial Coal Co. Imperial Mine	New plant (Adequate control measures)
Estes Park	Addition (Secondary)[b]
Fairplay	
South Platte Dredging Co.	Replace (Adequate control measures)
Federal Correctional Institution	Addition (Secondary)[b]
Fort Collins	Addition[c]
Dreher Pickle Co.	New plant (Secondary)
G-W Sugar Refinery	Addition (Secondary)
Fort Lupton	Addition (Secondary)
Fort Morgan	
Tiemann Packing Co.	Addition (Secondary)
G-W Sugar Refinery	Addition (Secondary)
M & B Packing Co.	Addition (Secondary)
Colorado (cont.)	
Fruitdale (S.D. #3)	New plant (Secondary)[a]
Georgetown	New plant (Secondary)
Golden (S.D. #17)	New plant (Secondary)[d]
Adolph Coors	New plant (Secondary)
Greeley	Addition (Secondary)
Associated Seed Growers, Inc.	Replace (Secondary)
G-W Sugar Refinery	Addition (Secondary)
Greeley Rendering Co.	Addition (Secondary)
Idaho Springs	New plant (Secondary)
Johnstown	New plant (Secondary)
Julesburg	New plant (Secondary)
H. E. Reichelt, Jr.	New plant (Adequate control meas.)
Lafayette	Addition (Secondary)[b]
Black Diamond Fuel Co.Mine #2	New plant (Adequate control measures)
Larimer Co.	
Cherry Products Co.	New plant (Secondary)
LaSalle	Replace (Secondary)
Farr Farms Potato Co.	Addition (Adequate control meas.)
Littleton (S.D. #21)	Enlarge & addition (Secondary)[b]
Longmont	Addition (Secondary)[b]
G-W Sugar Refinery	Addition (Secondary)
Kuner-Empson Cannery	New plant (Secondary)
Loretto Heights College	Addition (Secondary)
Louviers	
Dupont Nemours Co., Inc.	New plant (Primary)
Loveland	Two additions (Secondary)[b]
G-W Sugar Refinery	Addition (Secondary)
Kuner-Empson Canning Co.	New plant (Secondary)
Lucerne	
Lucerne Potato Growers	Addition (Adequate control meas.)
Weld Co. Potato Growers Assn.	Addition (Adequate control measures)
Lyons	New plant[e] (Secondary)[e]
Merino	New plant (Secondary)
Milliken	New plant (Secondary)
Ovid	New plant (Secondary)
G-W Sugar Refinery	New plant (Secondary)
Platteville	New plant (Secondary)
Platteville Potato Assn.	New plant(Adequate control meas.)
Silver Plume	
Mile High Mining Co.	Replace (Adequate control meas.)
Sterling	Addition (Secondary)
G-W Sugar Refinery	New plant (Secondary)
Sterling Rendering Works	New plant (Secondary)
Tollgate (S.D. #29)	New plant (Secondary)
Wellington	Addition (Secondary)
Westminster (S.D. #23)	Addition (Secondary)[b]
Wheatridge (S.D. #4)	Addition (Secondary)
Windsor	Addition (Secondary)[b]
G-W Sugar Refinery	New plant (Secondary)
Nebraska	
Chappell	Addition (Secondary)[a]
Kimball	Addition[c]
North Platte	New plant (Secondary)
Ogallala	(f) (e)
U.P.R.R. Water Plant	New plant (Adequate control meas.)
Sidney	Addition[c]
Star Packing Co.	New plant (Secondary)
U.P.R.R. Water Plant	New plant (Adequate control meas.)
Wyoming	
Cheyenne	
S. & S. Packing Co.	New plant (Secondary)
U.P.R.R. Shops	New plant (Adequate control meas.)

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[a] Under construction.

[b] Municipal secondary treatment plants which require secondary sedimentation units.

[c] Disinfection recommended for effluents of five existing secondary treatment plants.

[d] New plant under construction which will treat Coors industrial wastes and municipal wastes from Golden.

[e] Lyons is constructing a new primary plant. Protection of downstream water uses indicates that secondary treatment and efficient effluent disinfection are necessary.

[f] Existing secondary treatment plant requires reactivation.

Table 5. Missouri River Basin - Project list - Municipalities and industries needing improvements for abatement of pollution (cont.)

State Community Industry	Project needs
UPPER MISSOURI RIVER SUB-BASIN	
Montana	
Belgrade	Replace (Primary)
Big Sandy	Replace (Secondary)
Black Eagle	New plant (Primary)
Boulder—State Training School	Replace (Secondary)
Browning	Enlarge (Primary)
Browning—Blackfeet Indian Ag.	Replace (Secondary)[a]
Cascade	New plant (Primary)
Chester	New plant (Secondary)
Choteau	Replace (Primary)
Conrad	Replace (Secondary)
Cut Bank	Replace (Secondary)
Dillon	New plant (Primary)
East Helena	Replace (Primary)
Ft. Benton	New plant (Primary)
Ft. Harrison—V.A. Hospital	Replace (Secondary)
Ft. Peck	New plant (Primary)
Geraldine	Enlarge (Primary)
Glacier Park Station	Addition (Primary)
Glasgow	New plant (Primary)
Montana (cont.)	
Great Falls	New plant (Primary)
A.C.M. Reduction Plant	New plant (Lagoon)[b]
Great Falls Meat Co.	Replace (Primary)[b]
Great Northern R.R. Shops	Replace (Primary oil separator)
Phillips Oil Refinery	Addition (Oil separator)
Harlowton	Replace (Primary)
C.M.St.Paul & Pacific R.R.Shops	Addition (Oil separator)
Havre	
R.R. Shops	Addition (Oil separator)
Helena	New plant (Primary)
Hinsdale	Replace (Primary)
Lewistown	Addition (Secondary)
Malta	New plant (Primary)
Manhattan	Replace (Primary)
Roundup	Replace (Primary)
Saco	Replace (Secondary)
Shelby	New plant (Secondary)
Three Forks	New plant (Primary)
Townsend	Enlarge(Primary)
Twin Bridges—State Orphans Home	New plant (Secondary)
White Sulfur Springs	New plant (Secondary)
Winnett	Replace (Primary)

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[a] Or connect to an adequate existing sewer system.

[b] Or other equivalent pollution control measures.

State Community Industry	Project needs
YELLOWSTONE RIVER SUB-BASIN	
Montana	
Baker	Replace (Secondary)
Big Timber	Enlarge (Secondary)
Billings	Additional treatment (Chlorination)
Great Western Sugar Co. Ref.	New plant (Secondary)[a]
Pioneer Packing Co.	Replace (Secondary)[a]
Midland Packing Co. (cannery)	New plant (Secondary)[a]
Bridger	Enlarge (Secondary)
Broadus	New plant (Primary)
Crow Indian Agency Headquarters	Replace (Secondary)
Forsyth	Enlarge (Primary)
Ft. Keogh	New plant (Secondary)
Gardiner	Enlarge (Secondary)
Glendive	New plant (Primary)
Northern Pacific R.R. Shops	New plant (Primary)[a]
Hardin	Replace (Primary)
Holly Sugar Co. Refinery	New plant (Secondary)[a]
Hysham	Replace (Primary)
Laurel	
Co-Op Oil Refinery	Addition (Primary)[a]
Northern Pacific R.R. Shops	Addition (Primary)[a]
Livingston	New plant (Secondary)
Northern Pacific R.R. Shops	Replace (Primary)[a]
Lodge Grass	Replace (Secondary)
Miles City	New plant (Primary)
C.M.St.Paul & Pac.R.R. Shops	New plant (Primary)[a]
Red Lodge	
Red Lodge Cannery	Additional (Secondary)[a]
Sidney	New plant (Primary)
Holly Sugar Co. Refinery	New plant (Secondary)[a]
Wyoming	
Basin	New plant (Primary)
Buffalo	Enlarge (Secondary)
Cody	New plant (Secondary)
Husky Oil Refining Co.	Replace (Secondary)[a]
Cowley	
Cowley Canning Co.	Replace (Secondary)[a]
Greybull	New plant (Primary)
Hudson	New plant (Primary)
Lander	New plant (Primary)
Lovell	New plant (Primary)
Great Western Sugar Co. Ref.	New plant (Secondary)[a]
Powell	New plant (Primary)
Riverton	New plant (Primary)
Sheridan	Enlarge (Secondary)
Thermopolis	New plant (Primary)
Empire State Oil Refinery	Enlarge (Primary)
Hot Springs State Park	New plant (Primary)[a]
Worland	New plant (Primary)
Holly Sugar Refinery	Replace (Secondary)[a]
Yellowstone Park	
Canyon	Replace (Secondary)
Lake	Replace (Secondary)

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[a] Or other equivalent pollution control measures.

PART II. SUB-BASIN REPORTS

BIG SIOUX RIVER SUB-BASIN

This section is based upon the report "Big Sioux River Drainage Basin - A Cooperative State-Federal Report on Water Pollution" published October 1951. Data have been brought up-to-date as of January 1, 1953, by the respective State Health Departments of Iowa, Minnesota, and South Dakota.

General Description

The Big Sioux River rises in northeastern South Dakota and flows about 400 miles generally southward to join the Missouri River near Sioux City, Iowa. The lower one-third of the river forms the boundary between Iowa and South Dakota. The Basin is from 50 to 80 miles wide and has an area of 9,800 square miles. The principal tributary, Rock River, rises in southwestern Minnesota and flows in a southwesterly direction across northwestern Iowa to its confluence with the Big Sioux at a point approximately 10 miles north of Hawarden, Iowa.

Urban areas represent about 40 percent of the total population and include 2 cities of more than 10,000. Sioux Falls, South Dakota, is the largest city with a 1950 population of 53,746; Watertown, South Dakota, is second with 12,662. Basin population is estimated at 300,000. About 98 percent of the area is cultivated and 60 percent of the population is engaged in agriculture, the most importance source of income. The meat packing industry is also of great economic importance. Large plants are located at Sioux Falls, and Watertown, South Dakota; small abattoirs and locker plants may be found in most cities and towns.

No mineral resources of note have been located, although building stone of good quality is quarried near Sioux Falls and Dell Rapids in South Dakota. Considerable growth of industry, supported by increased agricultural activities as a result of the opening of new irrigation projects now under consideration in the adjacent James River Basin, is anticipated.

Water Uses

The waters of the Big Sioux River are utilized for numerous purposes, including development of power, some irrigation, livestock watering, recreation, bathing, cooling water for industrial plants, maintenance of the level of several lakes in the upper portion of the Basin, fish and wildlife propagation, muncipal water supply, and removal and ultimate disposal of sewage and industrial wastes.

The Flandreau Indian School uses river water for its domestic system, and Watertown, South Dakota, secures its supply from Lake Kampeska. These surface water supplies serve a population of 11,000 with 1,075,000 gallons per day. Forty-nine other cities and towns derive 8,183,000 gallons of water per day from ground sources. Ground water for the most part is highly mineralized, and in some instances limited in quantity. The ever increasing consumption of water from a limited underground supply is cause for concern, particularly at Sioux Falls, South Dakota.

Four permits have been issued for use of water for irrigation near Sioux Falls, and one has been granted the State Game Commission to divert water from the Big Sioux into Lake Poinsett. One permit has been issued to Sioux City Gas and Electric Company, Sioux City, Iowa, for cooling water use.

There is no commercial fishing except for a so-called turtle farm of small income located near Brookings, South Dakota. Sport fishing is popular in the headwaters of the Big Sioux and Rock Rivers, and in the Big Sioux from its junction with the Missouri to the mouth of the Rock River. Fish taken include channel catfish, bullhead, yellow pike-perch, fresh water drum, and carp. The Big Sioux River is not used for navigation, although considerable interest has been manifested in developing a boat harbor at the confluence of the Big Sioux and Missouri Rivers. Pleasure craft makes considerable use of the lower reaches of the stream.

The presence of a number of low head dams in the Big Sioux River has greatly enchanced its value as an aesthetic aid to parks and picnic areas. The value of clean water for these purposes is great. At least five different stream reaches of the Big Sioux are supplying these recreational needs.

The Big Sioux and its tributaries are extensively used for stock watering.

There is the possibility that in the future it will be necessary to use the Big Sioux River as a source of water supply for one or more municipalities. Such development is contingent upon a regulated flow sufficient to insure a year-round supply. This would be of appreciable monetary value to communities and industries as an alternate source of water, and as an alternate for an extremely high degree of sewage treatment. An increase in minimal flows would also bring about benefits to fish and wildlife resources, produce added hydroelectric power, and provide more and better recreational facilities.

A brief study has been made of the probable frequency of low monthly flows during the period of record. A summary of these data is shown in table BS-1. In computing the low mean monthly summer flow, the lowest monthly flow for the period June-September, inclusive, was used, while low mean monthly winter flows include December, and January and February of the following calendar year. Low summer flows are of interest because of critical oxygen conditions which may occur during periods of high temperature. However, where ice formation occurs, winter flows may assume greater importance. Ice coverage of a stream forms a barrier to the absorption of oxygen and can reduce or even eliminate the reaeration capacity of a stream.

Flow in most of the streams of the Big Sioux Basin is quite erratic. During prolonged drought periods most tributaries and portions of the Big Sioux itself have been completely dry. These periodic low flows contribute to the need for a high degree of waste treatment throughout the Basin.

Table BS-1. Big Sioux River Sub-Basin - Probable frequency of low mean monthly discharges

Years of record	Stream and location	Miles to mouth		Drainage area square miles	Minimum monthly mean flows in cubic feet per second that may be expected once in				
		Big Sioux River	Tributary		2 years	3 years	5 years	10 years	Minimum
	SUMMER PERIOD (JUNE-SEPT.)								
12	Big Sioux River Akron, Iowa	54.0		8,851	100	85	58	50	39
4	Rock River Luverne, Minn.	84.7	70.0	440	14.5	12.6	11.5	11	11
6	Big Sioux River Sioux Falls, S.D.	161.0		6,200	125	60	20	9	9
3	Big Sioux River Watertown, S.D.	362.8		1,053	4	2.5	1.6	1	1
	WINTER PERIOD (DEC.-FEB.)								
12	Big Sioux River Akron, Iowa	54.0		8,851	77	63	50	38	12
3	Rock River Luverne, Minn.	84.7	70.0	440	8	5	3.7	2	2
3	Big Sioux River Sioux Falls, S.D.	161.0		6,200	33.0	25.0	19.0	16.9	16.9
3	Big Sioux River Watertown, S.D.	362.8		1,053	4.0	2.3	0.8	0	0

Sources of Pollution

Pollution in this Basin originates from 44 municipalities and 6 separately sewered industries. Thirty-five municipal sewage treatment plants reduce the total pollutional load from communal systems by 85 percent; five industries provide treatment. These data are presented in tables BS-2 and BS-3 and are summarized in tables 1 and 2, Part I.

As indicated in table BS-2, industrial wastes discharged to municipal systems greatly exceed that of the domestic population. A large portion of the industrial waste of the Basin is produced in Sioux Falls and Watertown, South Dakota. These cities, by virture of their industry and population, are the principal sources of pollution.

The Big Sioux and its major tributary, the Rock River, are both interstate streams. While pollution of interstate waters is evident, it has not in the past posed a major problem.

A high degree of sewage treatment generally prevails throughout the drainage area. The problems of pollution were recognized by both State and municipal governments and a great deal of effort has been put forth in past years to bring about corrections. State legislation is generally adequate. Pollution below larger municipalities is serious because of the large amount of wastes from food processing establishments, the considerable volumes of domestic sewage, and frequent periods of critical low flow.

Municipal needs have been established for 9 new plants, 3 replacements, and 15 improvements. Industrial needs are listed for 1 new plant, 1 replacement, and 1 addition. The cost of recommended municipal and industrial waste treatment is estimated at $5,400,000. This is a conservative figure and does not include trunk sewers, operation, or maintenance.

Table [illegible]-2. Big Sioux River Sub-Basin - Basic data on sources of municipal pollution

Receiving stream, name, and location of municipality[1]	River miles[2] from mouth	Population served by sewers	Population equivalent of untreated wastes	Waste Treatment provided	Adequacy of treatment facilities Cap'y	Oper.	Population equivalent discharged to watercourse	Project needs	Current status of municipal action
Waubay Lake									
Webster, S.D.	(a)	2,800	2,800	Secondary	Unsat.	Sat.	(1,600)	Enlarge	Preliminary plans
Slough									
Bitter Lake									
Waubay, S.D.	(a)	800	800	Primary	Sat.	Sat.	(800)	None	-
Big Sioux River									
Watertown, S.D.	290	12,600	21,540	Secondary	Sat.	Unsat.	8,800	Enlarge	Inactive
Hidewood Creek	260								
Clear Lake, S.D.	30	980	900	Primary	Sat.	Unsat.	510	Addition	Preliminary plans
Estelline, S.D.	255	650	680	Primary	Sat.	Sat.	400	None	-
Slough									
[illegible], S.D.	(a)	600	940	Primary	Unsat.	Sat.	(280)	Addition	Inactive
Lake St. John									
Lake Norden, S.D.	(a)	460	460	Primary	Sat.	Unsat.	(400)	None	-
Lake Preston									
Lake Preston, S.D.	(a)	900	900	Secondary	Unsat.	Sat.	(300)	Addition	Inactive
Slough									
Arlington, S.D.	(a)	1,100	1,100	Secondary	Unsat.	Sat.	(400)	Addition	Preliminary plans
Big Sioux River									
Volga, S.D.	214	900[b]	900	Secondary[b]	Sat.	Sat.	140	None	-
Six Mile Creek	210								
White, S.D.	37	500	500	Secondary	Sat.	Sat.	100	None	-
Brookings, S.D.	10	7,000	7,000	Secondary	Unsat.	Sat.	2,800	Replace	Preliminary plans
Spring Creek	207								
[illegible], S.D.	23	600	600	Primary	Sat.	Sat.	300	None	-
Flandreau Creek	188								
Lake Benton, Minn.	40	900	1,070	Primary	Unsat.	Unsat.	780	Addition	Inactive
Flandreau, S.D.	180	2,000	2,000	Secondary	Sat.	Sat.	400	None	-
Flandreau Indian School, S.D.	180	600	600	Secondary	Sat.	Sat.	140	None	-
Bachelor Creek									
Colman, S.D.		480	600	Primary	Sat.	Sat.	400	None	-
Dell Rapids, S.D.	150	1,840	1,840	Secondary	Sat.	Sat.	300	None	-
Skunk Creek	132								
[illegible]	63								
Lake Madison	1								
[illegible] Creek	10								
Madison, S.D.	1	5,000	5,030	Secondary	Unsat.	Sat.	2,000	Addition	Plans approved
Tributary	36								
[illegible], S.D.	13	600	600	Secondary	Sat.	Sat.	90	None	-
Tributary	13								
Hartford, S.D.	4	880	880	Secondary	Unsat.	Sat.	380	Addition	Preliminary plans
Sioux Falls, S.D.	178	82,000	311,300	Secondary	Unsat.	Sat.	18,000	Enlarge	Preliminary plans
Split Rock Creek	154								
Pipestone Creek	47								
Pipestone, Minn.	34	5,300	8,100	Secondary	Unsat.	Unsat.	3,500	Enlarge	Inactive
Pipestone Indian School, Minn.	38	480	480	Secondary	Sat.	Sat.	100	None	-
Garretson, S.D.		600	600	None	-	-	600	New plant	Inactive
Canton, S.D.	121	2,500	2,500	None	-	-	2,500	New plant	Preliminary plans
Hudson, S.D.	90	480	480	None	-	-	480	New plant	Preliminary plans
Rock River	86								
Edgerton, Minn.	99	900	1,100	Secondary	Sat.	Sat.	440	None	-
Beaver Creek	97								
Lake Wilson, Minn.	34	380	380	None	-	-	380	New plant	Inactive
Luverne, Minn.	74	4,000	4,000	None	-	-	4,000	New plant	Preliminary plans
[illegible] River	67								
Adrian, Minn.	37	980	1,120	Primary	Unsat.	Unsat.	870	Addition	Inactive
Tributary	16								
Ellsworth, Minn.	4	680	770	Secondary	Sat.	Sat.	120	None	-
Rock Rapids, Iowa	45	2,800	3,400	None	-	-	3,400	New plant	Under construction
Doon, Iowa	34	400	400	Primary	Unsat.	Unsat.	300	Addition	Inactive
Little Rock River	22								
Little Rock, Iowa	44	400	400	Secondary	Sat.	Sat.	1[illegible]	None	-
George, Iowa	35	900	900	Secondary	Unsat.	Unsat.	600	Replace	Final plans approved
Otter Creek	17								
Sibley, Iowa	46	2,800	4,700	Secondary	Unsat.	Unsat.	980	Enlarge	Final plans approved
Ashton, Iowa	33	480	480	None	-	-	480	New plant	Inactive
Tributary	16								
Hull, Iowa	6	1,100	1,100	Secondary	Unsat.	Unsat.	800	Replace	Final plans approved
Rock Valley, Iowa	14	1,200	1,600	Secondary	Unsat.	Unsat.	1,200	Enlarge	Final plans approved
Tributary	11								
Inwood, Iowa	5	600	600	Secondary	Sat.	Unsat.	280	None	-
Hawarden, Iowa	73	2,400	2,400	None	-	-	2,400	New plant	Inactive
Akron, Iowa	30	1,000	1,100	None	-	-	1,100	New plant	Inactive
Brule Creek	35								
West Brule Creek	33								
Tributary	5								
Alcester, S.D.	2	880	880	Secondary	Sat.	Sat.	110	None	-
Totals		112,720	408,380				59,700		

[1] Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

[2] Approximate river miles.

[a] Landlocked area. Pollution does not reach watercourse.

[b] Ninety percent completed (completion spring 1965).

Table [illegible]-3. Big Sioux River Sub-Basin - Basic data on sources of industrial pollution - Industries discharging wastes directly to watercourse

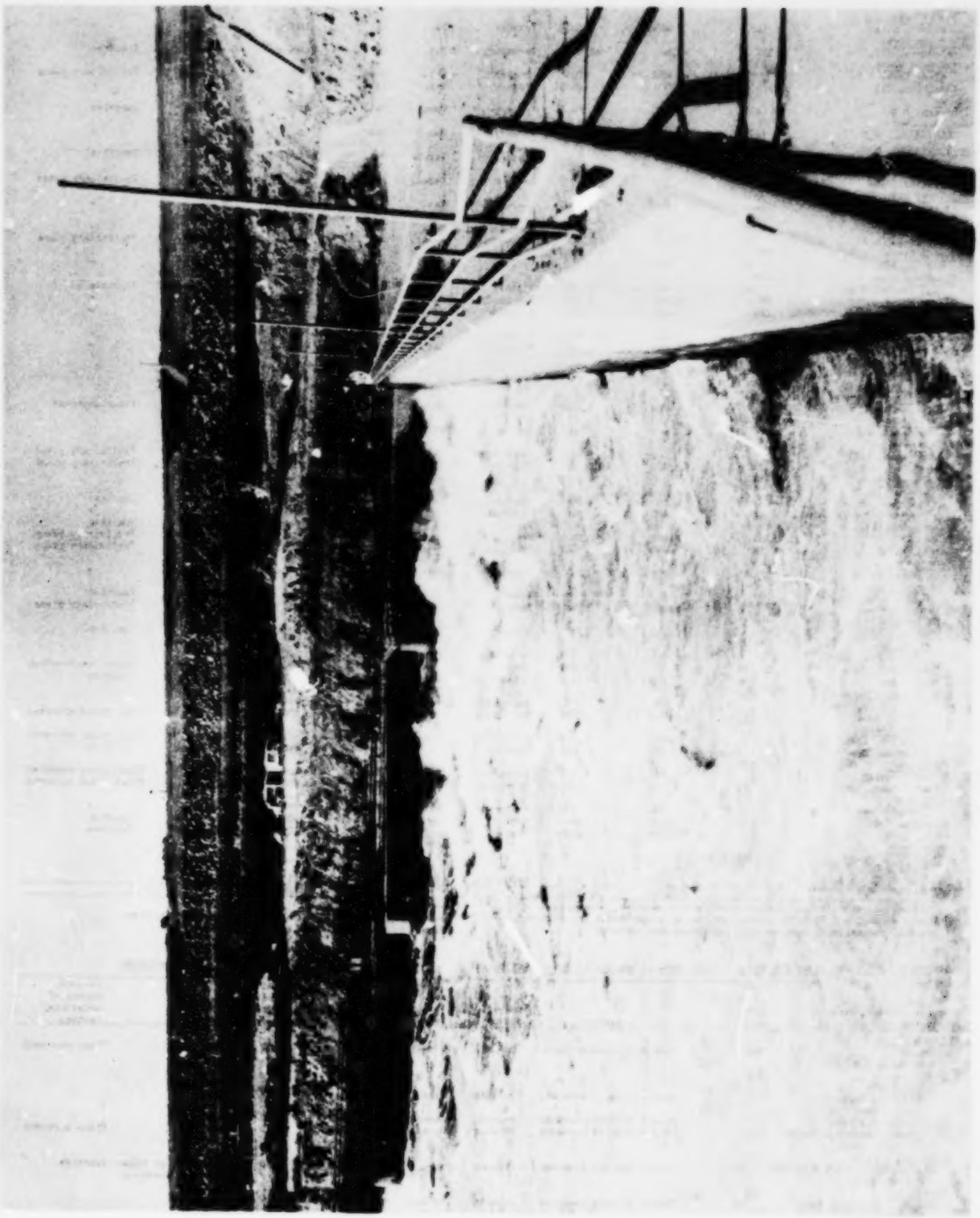
Receiving stream, name, and location of industry[1]	River miles[2] from mouth	Type of industry	Type of waste produced	Treatment or other pollution control measures Degree	Adequacy	Population equivalent discharged to watercourse	Project needs	Current status of industrial action
Big Sioux River								
[illegible] Watertown, S.D.	280	Food & kindred products	Organic	Primary	Inadequate	1,700	Replace	Plans approved
Slough	260							
Pelican Lake	3							
Rendering works Watertown, S.D.	1	Food & kindred products	Organic	Secondary	Adequate	(180)[a]	None	-
Sioux Falls Hog Farm	178	Food & kindred products	Organic	Lagoon	Adequate	80	None	-
Sioux Falls Rendering Works Sioux Falls, S.D.	178	Food & kindred products	Organic	Secondary	Inadequate	750	Addition	Plans approved
Split Rock Creek	154							
Jasper Creamery and Meat Mkt Jasper, Minn.	4	Food & kindred products	Organic	None	Inadequate	150	New plant or other control measures	Inactive
Rock River	86							
Edgerton Rendering Works Edgerton, Minn.	99	Food & kindred products	Organic	Partial	Adequate	(b)	None	-
Totals						2,680		

[1] Industries having separate outlets.

[2] Approximate river miles.

[a] Reaches watercourse only during high water.

[b] Does not reach watercourse.



Discharge from a multiple purpose reservoir

CENTRAL MISSOURI RIVER SUB-BASIN

This section is based upon the report "Central Missouri River Drainage Basin - A Cooperative State-Federal Report on Water Pollution" published June 1952. All data were brought up-to-date as of January 1, 1953, by the State Health Departments of Nebraska, North Dakota, South Dakota, and Wyoming.

General Description

The Basin, 64,600 square miles in area, includes the watershed of 430 miles of the Missouri River from Spring Creek in South Dakota to the Niobrara River in Nebraska. The Missouri River flows south from Spring Creek in north central South Dakota to Pierre, South Dakota, where it turns and flows southeast to its confluence with the Niobrara River.

The region is characterized by the peculiar shape of the valleys of the Missouri River and its tributaries, the Grand, Moreau, Cheyenne, Bad and White Rivers. Land adjacent to these valleys rises abruptly several hundred feet to plains or plateaus. The outstanding topographic features of the Basin are the Black Hills and Badlands of South Dakota.

The region is relatively sparsely settled, having a population of about 170,000 people. Rapid City, South Dakota, with a 1950 population of 25,177 is the largest municipality. Other principal cities include Pierre, Mobridge, Belle Fourche and Lead, South Dakota; Gillette and Newcastle, Wyoming; and Chadron, Nebraska.

The economy of the area is supported largely by dry-land farming, livestock grazing, and related industrial activity. Other important occupations are the mining and processing of gold, production and refining of oil, and catering to a large tourist trade. The gold mining and tourist industries are centered around the scenic Black Hills. Oil production is focused in the northeastern section of Wyoming.

The completion of the land and water resource development program of the Missouri River Basin holds promise of considerable improvement and stabilization of incomes for the residents of this semiarid region. The construction of 18 multiple purpose reservoirs will provide flood protection, furnish water for expanded and new irrrigation projects, increase the electrical power output for the region's industry, and augment existing recreational facilities. Dams on the main stem will control floods and regulate flows in the lower Missouri River for navigation, public water supply, and sanitation. Three of the proposed reservoirs authorized for the Basin have been completed and four more are presently under construction. Two major reservoirs were constructed prior to authorization of the Missouri River Basin Development Program and serve irrigation projects near Belle Fourche, South Dakota, and Whitney, Nebraska.

Water Uses

Surface water resources are utilized for irrigation, stock watering, fishing, and hydroelectric power development. Ground waters constitute the chief source of supply for municipal, domestic, and industrial users. Seventy-five communities in the Sub-Basin use ground waters to supply 8,524,000 gallons of water daily to 83,500 people. Approximately 17,000 people in 13 communities use 1,204,000 gallons a day from surface sources. It is anticipated that greater usage of surface water for potable purposes will occur.

Industries such as oil refineries, sugar beet refineries, and packing houses are major users of water for processing, cooling, washing, and air conditioning. Industrial water consumption in this region probably exceeds the domestic demand.

Irrigation has become most important since the opening of the Belle Fourche irrigation project in 1908. In 1948, 39,000 acres of this project were under irrigation. A tract of about 10,000 acres was opened to irrigation in 1922 near Whitney, Nebraska. Several other smaller areas, particularly along Rapid Creek east of Rapid City, South Dakota, and near Sundance and Newcastle, Wyoming, are now being irrigated. Irrigation will undoubtedly expand with the development of additional reservoirs. It is anticipated that more than 100,000 acres will be brought under irrigation in the relatively near future.

Hydroelectric power has benefited gold mining operations, oil refining, and local industry. Eight hydroelectric power plants with an installed capacity of 11,500 kilowatts lie within the Basin. The hydroelectric plant constructed at Angostura Dam will produce power part of which will be used for pumping water to irrigate approximately 25,000 acres of nearby land. Eventually, the latter plant probably will be interconnected with the Missouri River Basin system and pumping energy secured from the integrated system. Three major dams, Oahe, Big Bend, and Fort Randall on the main stem of the Missouri, will produce firm power. Oahe, now under construction, has a tentative installed capacity of 425,000 kilowatts; Big Bend, a tentative 120,000 kilowatts; and Fort Randall, also under construction, 320,000 kilowatts. The average future annual generation capacity of the combined main stem plants is estimated at 3.5 billion kilowatt-hours.

Oahe and Fort Randall Reservoirs will serve their prime purposes of controlling floods and of supplying water for irrigation, navigation, municipal, and industrial needs in the lower Missouri River. Attending benefits include the reduction of silt and the creation of recreational facilities. Additional flood control reservoir sites in the Black Hills are being investigated.

The extreme paucity of surface water throughout the Basin, with the exception of the Black Hills, has made that which is available very attractive to local recreational interests. Hidden Wood, Molestead, Flat Creek, Sully, Corsica, Durkee, Campbell and Hurley Lakes and Lake Andes, are popular recreational areas and are utilized intensively by local residents for picnicking, and fishing. These lakes, except for Lake Andes that has both a State and Federal wildlife refuge on it, are subject to considerable hunting pressure. All these lakes are within South Dakota, yet outside of the

Black Hills. Streams and lakes within the Black Hills area provide excellent fishing besides being very important adjuncts to the scenery. The Belle Fourche Reservoir has a history of good and bad fishing years, however, the absence of other local fishing grounds attracts fishermen to it from a wide area.

A study has been made of the probable frequency of low monthly flows during the period of record. A summary of the results is shown in table CM-1. In computing the probable frequency of low mean monthly summer flows, the lowest monthly flow each year for the period June-September, inclusive, was used, while low mean monthly winter flows include December, and January and February of the following calendar year. These values are subject to modification on streams having or which will have comparatively large amounts of conservation storage. Low flows are of interest because of critical oxygen conditions which may occur. Low summer flows are generally more important because of the reduced oxygen capacity of streams at high temperatures, although where ice formation exists, winter flows may be critical since ice coverage forms a barrier to the absorption of oxygen, and can reduce or even eliminate the reaeration capacity of a stream. Such adverse conditions may require either increased quantities of dilution water or a higher degree of waste treatment.

Sources of Pollution

Municipal wastes have caused localized damages, however the great distances between sources of pollution and the relatively small amounts contributed have enabled the streams to absorb the polluting materials without far reaching damages to water uses. Organic industrial wastes and inorganic wastes from the mining and petroleum industries have been responsible for some adverse effects on aquatic life of the streams.

Sixty-six municipalities have sewer systems serving an estimated 106,670 people. Fifty-one communities have facilities for treating wastes from 70 percent of the sewered population; over-all pollution reduction is 47 percent. Treated and untreated municipal waste discharged to streams amounts to about 58,000 population equivalents. Eight industrial plants discharge waste to watercourses, the largest of which discharges a seasonal organic population equivalent of 57,000. These data are presented in tables CM-2 and CM-3 and are summarized in tables 1 and 2, Part I.

The probability of greatly increased water usage within the region and the necessity of protecting such future uses makes pollution control extremely important. Fourteen new sewage treatment plants, enlargements or additions to 12 existing municipal plants, replacement of 9 existing municipal plants, and enlargements or additions to 7 existing industrial waste treatment plants are needed. The estimated cost of providing these facilities, without attending sewer appurtenances and excluding operation and maintenance is $2,500,000.

Although several streams are interstate in character they carry little or no pollution in those reaches and no interstate pollution problems have been reported.

Table CM-1. Central Missouri River Sub-Basin - Probable frequency of low mean monthly discharge

Years of record	Stream and Location	Drainage area square miles	Minimum monthly mean flows in cubic feet per second that may be expected once in: 2 years	5 years	10 years	Minimum
	SUMMER PERIOD (JUNE-SEPT)					
	Missouri River					
14	Mobridge, S. D.	208,700	11,607	8,319	5,835	4,998
13	Pierre, S. D.	243,500	10,685	8,378	5,934	4,790
	Grand River					
5	Shadehill, S. D.	3,120	10	9	8	7.94
13	Wakpala, S. D.	5,510	3	1	0	0
	Moreau River					
5	Faith, S. D.	2,660	6	4	2	2.09
5	Eagle Butte, S. D.	4,320	5	1	0.1	0.10
13	Promise, S. D.	5,283	1	0.08	0	0
	Cheyenne River					
5	Hot Springs, S. D.	8,710	19	18	18	18.0
12	Wasta, S. D.	12,800	46	37	30	27.9
13	Eagle Butte, S. D.	24,500	216	113	79	46.9
	Fall River					
8	Hot Springs, S. D.	137	86	85	85	84.8
	Beaver Creek					
10	Buffalo Gap, S. D.	130	1	1	1	0.51
	Rapid Creek					
6	Rapid City, S. D.	410	42	40	38	38.0
	Belle Fourche River					
10	Moorcroft, Wyoming	1,730	0.1	0	0	0
10	Hulett, Wyoming	2,800	4	1	1	0.94
9	Belle Fourche, S. D.	4,310	27	20	12	9.5
12	Elm Springs, S. D.	7,210	131	53	23	0.217
	Bad River					
12	Fort Pierre, S. D.	3,107	0	0	0	0
	North Fork Bad River					
6	Philip, S. D.	164	0	0	0	0
	White River					
8	Crawford, Nebr.	295	9	9	9	8.34
8	Chadron, Nebr.	750	2	2	2	1.65
5	Oglala, S. D.	2,200	23	17	11	11.4
6	Kadoka, S. D.	5,000	41	26	18	17.2
13	Oacoma, S. D.	10,200	57	48	20	0.75
	South Fork White River					
5	Rosebud, S. D.	1,020	52	51	50	49.9
	WINTER PERIOD (DEC.-FEB.)					
	Missouri River					
14	Mobridge, S. D.	208,700	5,684	5,271	4,953	3,381
13	Pierre, S. D.	243,500	5,693	5,585	4,838	3,261
	Grand River					
4	Shadehill, S. D.	3,120	0.6	0.2	0	0
12	Wakpala, S. D.	5,510	0	0	0	0
	Moreau River					
4	Faith, S. D.	2,660	0.3	0.1	0	0
4	Eagle Butte, S. D.	4,320	0	0	0	0
10	Promise, S. D.	5,283	0	0	0	0
	Cheyenne River					
4	Hot Springs, S. D.	8,710	21	20	19	19.3
10	Wasta, S. D.	12,800	58	44	39	36.3
13	Eagle Butte, S. D.	24,500	44	31	23	8.7
	Fall River					
8	Hot Springs, S. D.	137	26	24	15	11.8
	Beaver Creek					
10	Buffalo Gap, S. D.	130	8	8	7	6.9
	Rapid Creek					
5	Rapid City, S. D.	410	34	33	33	32.6
	Belle Fourche River					
5	Moorcroft, Wyoming	1,730	0	0	0	0
9	Hulett, Wyoming	2,800	3	1	1	0.4
9	Belle Fourche, S. D.	4,310	127	103	94	92.1
10	Elm Springs, S. D.	7,210	15	7	3	2.0
	Bad River					
11	Fort Pierre, S. D.	3,107	0	0	0	0
	North Fork Bad River					
5	Philip, S. D.	164	0	0	0	0
	White River					
7	Crawford, Nebraska	295	18	18	17	16.8
8	Chadron, Nebraska	750	4	3	1	1.0
4	Oglala, S. D.	2,200	12	9	7	7.2
5	Kadoka, S. D.	5,000	23	15	8	8.1
13	Oacoma, S. D.	10,200	43	19	14	12.8
	South Fork White River					
4	Rosebud, S. D.	1,020	63	57	53	54.4

Table CM-2. Central Missouri River Sub-Basin - Basic data on sources of municipal pollution

Receiving stream, name and location of municipality¹	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) untreated waste	Waste treatment provided	Adequacy of treatment facilities: Cap.	Adequacy of treatment facilities: Oper.	Population equivalent discharged to watercourse	Project needs	Current status of municipal action
Missouri River	1284.0								
Spring Creek	32.0								
[illegible] Creek									
Zeeland, N. D.	10.0	450	450	Lagoon	Sat.	Sat.	(a)	None	-
[illegible] Lake	-								
Eureka, S. D.	-	1,200	1,200	None	-	-	(b)	None	-
Herreid, S. D.	18.0	600	600	Primary	Sat.	Sat.	400	None	-
Oak Creek	1255.0								
McLaughlin, S. D.	35.0	650	650	Primary	Sat.	Unsat.	450	None	-
Grand River	1253.6								
North Fork	249.0								
[illegible] Creek	97.2								
Lemmon, S. D.	35.0	890	890	Primary	Unsat.	Sat.	620	Enlarge	Inactive
South Fork	209.0								
Buffalo, S. D.	17.0	370	370	Primary	Sat.	Sat.	260	None	-
Hidden Wood Creek	195.0								
Hettinger, N. D.	30.0	1,600	1,600	Minor^{2}	Unsat.	Unsat.	1,440	Replace	Inactive
[illegible] Creek	97.0								
McIntosh, S. D.	15.0	600	600	Primary	Sat.	Sat.	450	None	-
Mobridge, S. D.	1250.6	3,500	3,800	None	-	-	3,800	New plant	Inactive
Moreau River	1230.5								
Thunder Butte Creek	169.5								
[illegible], S. D.	43.0	300	300	Primary	Sat.	Unsat.	210	None	-
[illegible] Creek	130.0								
[illegible] Creek	11.0								
Dupree, S. D.	8.0	400	400	Secondary	Sat.	Sat.	80	None	-
Timber Lake	-								
Timber Lake, S. D.	-	500	500	Primary	Unsat.	Unsat.	400	Enlarge	Inactive
Swan Creek	1229.0								
Hosmer, S. D.	Landlocked	-	-	(Primary)^{4}	-	-	-	-	-
Bowdle, S. D.	50.0	700	700	Primary	Unsat.	Unsat.	490	Enlarge	Inactive
Java, S. D.	35.0	250	250	Primary	Sat.	Sat.	170	None	-
Selby, S. D.	28.0	460	460	Primary	Sat.	Unsat.	400	None	-
Cheyenne Indian Agency, S. D.	1208.0	1,200	1,200	None	-	-	1,200	New plant	Inactive
Cheyenne River	1163.8								
Beaver Creek	277.6								
Upton, Wyo.	70.0	600	600	Minor^{2}	Unsat.	Unsat.	600	Enlarge	Inactive
[illegible] Creek	13.0								
Newcastle, Wyo.	20.0	3,300	3,300	None	-	-	3,300	New plant	Final plans approved
Edgemont, S. D.	285.2	900	900	None	-	-	900	New plant	Inactive
Fall River	236.0								
Hot Springs, S. D.	6.0	5,000	5,000	Secondary	Sat.	Sat.	450	None	-
Beaver Creek	225.0								
Sanator-State T.B.Hospital, S.D.	45.0	300	300	Secondary	Sat.	Sat.	60	None	-
French Creek	195.0								
Custer, S. D.	35.0	2,100	2,100	Secondary	Sat.	Sat.	350	None	-
Rapid Creek	166.2								
Rapid City, S. D.	43.3	25,000	26,400	Secondary	Sat.	Sat.	2,260	None	-
Boxelder Creek	152.2								
Rapid City-Army Air Base, S.D.	32.0	900	900	Secondary	Sat.	Sat.	90	None	-
[illegible] Creek	145.0								
Wall, S. D.	15.0	500	500	Lagoon	Sat.	Sat.	(a)	None	-
Belle Fourche River	115.6								
Moorcroft, Wyo.	316.0	300	300	Minor^{2}	Unsat.	Unsat.	150	Enlarge	Inactive
Donkey Creek	314.0								
Gillette, Wyo.	40.0	2,200	2,200	Primary	Unsat.	Unsat.	2,200	Replace	Inactive
Belle Fourche, S. D.	150.0	3,000	3,000	None	-	-	3,000	New plant	Inactive
Redwater River	148.2								
[illegible] Creek	28.0								
Sundance, Wyo.	25.0	-	-	(Lagoon)^{6}	-	-	-	-	-
Spearfish Creek	9.7								
Spearfish, S. D.	9.7	2,500	2,500	Secondary	Unsat.	Sat.	550	Enlarge	Planning initiated
Nisland, S. D.	130.0	210	210	Primary	Sat.	Sat.	150	None	-
Whitewood Creek	110.0								
Lead, S. D.	40.0	6,300	6,300	None	-	-	6,300	New plant	Inactive
Deadwood, S. D.	35.0	3,100	3,100	None	-	-	3,100	New plant	Inactive
Indian Creek	98.0								
Newell, S. D.	12.0	500	500	Primary	Unsat.	Unsat.	400	Replace	Inactive
Bear Butte Creek	80.0								
Sturgis, S. D.	27.0	3,400	3,400	Secondary	Sat.	Sat.	680	None	-
Cherry Creek	50.0								
[illegible] Creek	35.0								
Faith, S. D.	15.0	400	400	Secondary	Unsat.	Sat.	150	Enlarge	Inactive
Okobojo Creek	1138.0								
Hoven, S. D.	100.0	400	400	Secondary	Sat.	Sat.	80	None	-
Gettysburg, S. D.	60.0	1,200	1,200	Primary	Unsat.	Sat.	800	Enlarge	Inactive
Dry Lake Bed	-								
Onida, S. D.	-	600	600	Primary	Unsat.	Sat.	(b)	Enlarge	Inactive
Pierre, S. D.	1117.5	5,000	5,000	None	-	-	5,000	New plant	Inactive
Ft. Pierre, S. D.	1116.4	850	850	None	-	-	850	New plant	Inactive
Bad River	1116.4								
Philip, S. D.	127.0	650	650	Primary	Unsat.	Unsat.	450	Replace	Inactive
White [illegible] Creek	114.5								
Kadoka, S. D.	20.0	400	400	Primary	Unsat.	Unsat.	300	Replace	Planning initiated
Midland, S. D.	90.0	300	300	Primary	Sat.	Unsat.	140	None	-
Pierre-Indian School, S. D.	1115.0	500	500	None	-	-	500	New plant	Inactive
Medicine Creek	1067.0								
Presho, S. D.	50.0	400	400	Primary	Unsat.	Unsat.	280	Replace	Inactive
Ft. Thompson-Indian Agency, S.D.	1031.6	500	500	None	-	-	500	New plant	Inactive
Crow Creek	1025.0								
[illegible] Creek	7.0								
Kimball, S. D.	35.0	800	800	Primary	Unsat.	Unsat.	600	Replace	Inactive
American Creek	1012.9								
Pukwana, S. D.	30.0	200	200	Secondary	Sat.	Sat.	30	None	-
Chamberlain, S. D.	1012.9	1,800	1,800	None	-	-	1,800	New plant	Final plans approved
White River	999.9								
Crawford, Nebr.	482.0	1,700	1,700	Secondary	Unsat.	Sat.	510	Enlarge	Inactive
Chadron Creek	440.0								
Chadron, Nebr.	5.0	4,500	4,500	Minor^{2}	Unsat.	Sat.	4,500	Replace	Inactive
White Clay Creek	384.0								
Pine Ridge-Indian Agency, S.D.	23.0	1,000	1,000	Secondary	Sat.	Sat.	190	None	-
Bear in the Lodge Creek	262.0								
Martin, S. D.	75.0	500	500	Secondary	Sat.	Sat.	100	None	-
Little White River	123.0								
Rosebud Creek	40.8								
Rosebud-Indian Agency, S.D.	4.0	350	350	Secondary	Sat.	Sat.	50	None	-
Dog Ear Creek	63.0								
Winner, S. D.	38.0	3,000	3,000	Secondary	Sat.	Sat.	300	None	-

Table CM-2. Central Missouri River Sub-Basin - Basic data on sources of municipal pollution (contd.)

Receiving stream, name and location of municipality[1]	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) untreated waste	Waste treatment provided	Adequacy of treatment facilities: Capy.	Adequacy of treatment facilities: Oper.	Population equivalent discharged to watercourse	Project needs	Current status of municipal action
Missouri River									
Platte Creek	956.0								
White Lake, S. D.	50.0	350	350	Secondary	Sat.	Unsat.	200	None	-
Platte, S. D.	15.0	1,000	1,000	Secondary	Sat.	Unsat.	250	None	-
Whetstone Creek	940.0								
Burke, S. D.	30.0	750	900	Primary	Sat.	Sat.	630	Addition	Inactive
Ponca Creek	934.0								
[illegible], S. D.	12.0	450	450	None	-	-	450	New plant	Inactive
Lake Andes Creek	925.0								
Lake Andes, S. D.	8.0	1,000	1,000	Primary	Unsat.	Unsat.	1,000	Replace	Planning initiated
Pickstown, S. D.	881.0	2,000	2,000	Primary	Sat.	Sat.	1,500	None	-
Choteau Creek	877.0								
Armour, S. D.	55.0	850	850	Secondary	Sat.	Sat.	250	None	-
Wagner, S. D.	30.0	1,200	1,200	Primary	Unsat.	Sat.	800	Enlarge	Inactive
Dry Choteau Creek	10.0								
Avon, S. D.	10.0	500	500	None	-	-	500	New plant	Inactive
Totals		106,670	106,720				57,590		

[1] Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

[a] Discharge to an artificial lagoon - no outlet to watercourse.

[b] Discharge to a dry lake bed - no pollution reaches watercourse.

[c] Septic tank.

[d] Sewer system and treatment plant now under construction will discharge to a landlocked slough.

[e] Bonds have been voted for construction of a sewage system which will discharge to an artificial lagoon with no outlet to a watercourse.

Table CM-3. Central Missouri River Sub-Basin - Basic data on sources of industrial pollution - Industries discharging wastes directly to watercourse

Receiving stream, name and location of industry[1]	River miles from mouth	Type of industry	Type of waste produced	Treatment or other pollution control measures: Degree	Treatment or other pollution control measures: Adequacy	Population equivalent (B.O.D.) discharged to watercourse	Project needs or equivalent control measures	Current status of industrial action
Missouri River								
Cheyenne River	1163.8							
Lance Creek	320.0							
Lance Creek Oil Field Niobrara Co., Wyo.	-	Crude petroleum	Organic	Minor	Inadequate	-	Addition	Inactive
Beaver Creek	297.6							
[illegible] & Bradley Oil Refinery, Osage, Wyo.	48.0	Petroleum products	Organic and inorganic	Minor	Inadequate	-	Addition	Inactive
[illegible] Creek	15.0							
Carter Oil Refinery	20.0	Petroleum products	Organic and inorganic	Minor	Inadequate	-	Enlarge	Inactive
Gross Oil Refinery	20.0	Petroleum products	Organic and inorganic	Minor	Inadequate	-	Enlarge	Inactive
Wyoming Gas & Oil Co. Newcastle, Wyo.	20.0	Petroleum products	Organic and inorganic	Minor	Inadequate	-	Enlarge	Inactive
Belle Fourche River	115.6							
U & I. Sugar Refinery Belle Fourche, S. D.	150.0	Food and kindred products	Organic	Partial	Inadequate	57,000	Enlarge and addition	Inactive
Red Water River	148.2							
Sundance Creek	28.0							
Crook Co. Oil Refinery Sundance, Wyo.	25.0	Petroleum products	Organic and inorganic	Partial	Inadequate	-	Enlarge	Inactive
Whitewood Creek	110.0							
Homestake Gold Mine Lead, S. D.	40.0	Metal mining	Inorganic	None	-	Not applicable	None[2]	-
Total						57,000		

[1] Industries having separate outlets.

[2] Whitewood Creek is a Class "B" stream into which untreated waste may be discharged.

While considerable progress has been made in pollution control by the Nebraska and North Dakota State Water Pollution Control Agencies, their effectiveness would be considerably enhanced if adequate State legislation giving them broader powers were available. Recently enacted amendments to Wyoming legislation greatly improve the State Water Pollution Control Agency's ability to cope with these problems. Control legislation in South Dakota has proved quite effective.

This sewer discharges untreated wastes equal to that from 500,000 people

Tarry wastes causing unsightly conditions

GRAND-CHARITON RIVERS SUB-BASIN

This section is based upon the report "Grand-Chariton Drainage Basins-A Cooperative State-Federal Report on Water Pollution" published June 1952. Data have been brought up-to-date as of January 1, 1953, by the State Health Departments of Iowa and Missouri.

General Description

The Grand-Chariton Rivers Basin is characterized by low, rolling hills having a well defined drainage pattern. They contain 10,900 square miles of area. The Grand River rises in southern Iowa near the town of Afton. It flows southwesterly to the Missouri State line then bends and continues in a southeasterly direction to its junction with the Missouri, 251.8 miles above the mouth of the Missouri River. The Grand River is 217 miles long and drains an area of 7,900 square miles. The average discharge during years of record of the Grand River near Sumner, Missouri, is 3,949 cubic feet per second. The Chariton River also rises in south central Iowa, near Weldon. It follows a southeasterly course to the Missouri-Iowa border, then flows in a generally southerly direction to its confluence with the Missouri River 24 miles downstream from the mouth of the Grand River. The Chariton River is 280 miles long and drains about 3,000 square miles of area. The average discharge of the Chariton River near Keytesville, Missouri, is 1,092 cubic feet per second.

The present population of the Basin is estimated at 313,000 of whom 200,000 reside in the Grand River section and the remainder in the Chariton drainage area. A steady decline in population has occurred since 1920 with the greatest percentage of loss in rural areas. The numerous cities and towns serve chiefly as marketing and distribution centers for the agricultural produce of the area. Moberly, Missouri, population 12,833, 1950 census, is the largest city.

Since the days of the early settlers agriculture has been the dominant industry. Corn is the principal crop, however, considerable quantities of oats, wheat, and hay are produced; most of the grain and hay are fed to livestock. Dairying and poultry raising are important sources of income. Portions of the Basin also are well suited for tobacco growing. Approximately 60 percent of the gainfully employed persons are dependent on agriculture and related industries. High grade bituminous coal is the most important mineral resource. Coal is strip mined readily and supplies markets in Iowa and Missouri. Sand and gravel deposits furnish construction material for local use.

Water Uses

Water resources are used extensively for public water supply, livestock watering, fish and wildlife propagation, recreation, and for removal and ultimate disposal of domestic and industrial wastes. Three miles of the Grand River above its mouth are considered navigable, however, the only commerical craft using it in recent years have been sand barges.

Surface water resources of the Grand-Chariton Rivers Basin supply the public systems of 25 municipalities serving a population of 59,000 with 5,800,000 gallons daily. The high mineral content of ground waters has encouraged the development of surface sources for public supplies. Eleven municipal supplies are taken from wells to serve 10,800 people with 650,000 gallons each day.

During the past two decades numerous stock watering and soil conservation ponds have been constructed throughout the area. Many of these serve several purposes, including recreation and propagation of fish life. The streams do not offer many opportunities for recreation nor lend themselves to the development of valuable fisheries because of low flow experienced almost every summer and fall. However, relatively good catches of catfish, carp, and fresh-water drum are reported.

Prior to 1900 the streams were used extensively as sources of water power for local grist mills, however, the mills have long since been abandoned. No hydroelectric power is being produced within the confines of the Basin. Navigation is now practically nonexistent on the streams, although at one time the Grand River formed an important artery of transportation. Use of the streams for removal and ultimate disposal of municipal and industrial wastes is important.

The State governments of both Iowa and Missouri have encourgaged greater development of the water resources of the area. The Corps of Engineers, Department of the Army, has proposed the construction of reservoirs, levees, and channel straightening for the primary purpose of controlling floods. The reservoirs would also serve several other very important water uses. It is expected that the completion of this conservation program will lead to increased numbers of surface water supplies, greater recreational opportunities, and better pollution control.

A brief study has been made of the probable frequency of low mean monthly flows (Table GC-1). In computing the low mean monthly summer flow, the lowest monthly flow each year for the period June-September, inclusive, was used. Low mean monthly winter flows include December, and January and February of the following calendar year. Low summer flows are of interest because of critical oxygen conditions which may occur during periods of high temperature. Low winter flows are of less importance normally because of the high oxygen capacity of streams at low temperatures and the naturally greater flows which occur during the winter. However, where ice formation exists, winter flows may be critical where ice coverage forms a barrier to the absorption of oxygen thereby reducing or even eliminating the reaeration capacity of the stream. Such conditions may require either increased quantities of dilution water, or a higher degree of waste treatment.

Sources of Pollution

Waterways of the Grand-Chariton Basin receive sewage from 33 municipalities and 5 separately discharging industries. These data are tabulated in tables GC-2 and GC-3 and summarized in tables 1 and 2, Part I. Untreated wastes are discharged by 7 communities and 2 industries. Installed treatment at 26 communities serving 74.5 percent of the sewered population

Table GC-1. Grand-Chariton Rivers Sub-Basin - Probable frequency of low mean monthly discharges

Years of record	Stream and location	Miles to mouth: Grand River	Miles to mouth: Tributary	Drainage area square miles	Minimum monthly mean flows in cubic feet per second that may be expected once in: 2 yrs.	3 yrs.	5 yrs.	10 yrs.	Minimum flow of record c.f.s.
	SUMMER PERIOD (JUNE-SEPT)								
	Grand River								
16	Sumner, Mo.	39		6,880	367	384	284	99	41
16	Gallatin, Mo.	90		2,250	90	58	39	18	7
	Thompson River	64							
13	Trenton, Mo.		26	1,670	102	56	33	8	6
	Weldon River		28						
14	Mill Grove, Mo.		18	494	14	8	3	1	1
8	Mercer, Mo.		40	246	7	3	2	1	0.03
	Big Creek	108							
	East Fork		25						
11	Bethany, Mo.		1	95	0.40	0.1	0.05	0.02	0
	Medicine Creek	50							
15	Galt, Mo.		32	225	5	3	2	1	0.22
	Locust Creek	42							
14	Linneus, Mo.		21	550	13	6	1	0.4	0.0096
		Miles to mouth: Chariton River	Tributary						
	Chariton River								
13	Keytesville, Mo.	39		1,950	74	40	30	12	8
12	Novinger, Mo.	140		1,370	86	19	7	2	1
8	Centerville, Iowa	196		727	13	10	6	4	4
	WINTER PERIOD (DEC-FEB)								
	Grand River								
16	Sumner, Mo.	39		6,880	450	282	153	128	38
16	Gallatin, Mo.	90		2,250	81	51	39	20	4
	Thompson River	64							
13	Trenton, Mo.		26	1,670	89	43	36	20	6
	Weldon River		28						
13	Mill Grove, Mo.		12	494	16	8	6	3	1
8	Mercer, Mo.		40	246	25	8	3	1	0.16
	Big Creek	108							
	East Fork		25						
10	Bethany, Mo.		1	95	3	1	0.1	0	0
	Medicine Creek	50							
16	Galt, Mo.		32	225	15	5	3	3	0.03
	Locust Creek	42							
14	Linneus, Mo.		21	550	49	11	5	3	0.0024
		Miles to mouth: Chariton River	Tributary						
	Chariton River								
13	Keytesville, Mo.	39		1,950	209	66	43	22	14
13	Novinger, Mo.	140		1,370	119	32	16	12	4
8	Centerville, Iowa	196		727	104	28	6	3	2

reduces municipal pollution by about 45 percent. One industry provides adequate treatment measures.

Seventy miles of the East Fork of the Chariton River and 70 miles of the Chariton River are polluted by inorganic acid mine waste. Sections of the streams mentioned are in a state of chronic pollution and reportedly aquatic life has been practically eliminated from these reaches.

A resume of municipal waste treatment needs indicates 7 new plants, addition to or enlargement of 18, and replacement of 6. New treatment works for industrial wastes are needed at 2 industries and 2 existing treatment installations should be replaced. While pollutional effects from acid mine drainage have been recorded by the Missouri State Conservation Commission, this problem merits additional study in Iowa. Cost of providing the recommended improvements is conservatively estimated at $2,500,000. This figure does not include construction of new systems where none now exist nor does it consider interceptors, operation or maintenance.

Damages to water resources by pollution are limited to local areas extending for relatively short distances below points of waste discharge. The substantial degree of pollution control now in existence in the Grand-Chariton Basin is the result of progressive programs by the State Water Pollution Control Agencies of Iowa and Missouri and a concerned local citizenry. Most of the municipalities appear willing to provide the necessary improvements when satisfactory municipal financing programs can be arranged. An act recently passed by the Missouri State Legislature enables Missouri cities to finance sewage treatment by revenue bonds to be retired by sewer service charges, thus permitting effective and flexible financing of sewage treatment works. Legislation in Iowa appears adequate. The enactment of comprehensive stream pollution control legislation in the State of Missouri would tend to further stimulate stream pollution control.

Table GC-2. Grand-Chariton Rivers Sub-Basin - Basic data on sources of municipal pollution

Receiving stream, name and location of municipality¹	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) untreated waste	Waste treatment provided	Adequacy of treatment facilities Cap.	Adequacy of treatment facilities Trmt.	Population equivalent discharged to watercourses	Project needs	Current status of municipal action
Missouri River									
Grand River²	251.8								
[illegible] Creek	147.0								
Stanberry, Mo.	5.0	1,120	1,120	None	-	-	1,120	New plant	Final plans approved
Middle Fork	144.0								
Branch	18.0								
Grant City, Mo.	4.0	260	260	Primary	Unsat.	Unsat.	180	Replace	Final plans approved
East Fork	142.0								
Mt. Ayr, Ia.	41.0	1,300	1,300	Secondary[a]	Unsat.	Unsat.	800	Replace	Inactive
Albany, Mo.	3.0	1,550	1,650	Secondary	Sat.	Sat.	150	None	-
Grindstone Creek	112.0								
Lost Creek	10.0								
West Fork Lost Creek	5.0								
Maysville, Mo.	4.0	700	700	Secondary	Sat.	Sat.	100	None	-
Big Creek	108.0								
East Branch Big Creek	20.0								
Lamoni, Ia.	33.0	1,600	2,800	Secondary	Unsat.	Unsat.	1,800	Replace	Plans under preparation
Branch	10.0								
Ridgeway, Mo.	5.0	160	160	Secondary	Unsat.	Unsat.	40	Enlarge	Inactive
Bethany, Mo.	1.0	2,480	2,480	Secondary	Sat.	Unsat.	1,000	None	-
Gallatin, Mo.	90.0	770	770	None	-	-	770	New plant	Inactive
Lick Fork	83.0								
Hamilton, Mo.	12.0	1,030	1,030	Secondary	Sat.	Sat.	200	Enlarge	Inactive
Thompson River	64.0								
Greenfield, Ia.	140.0	1,600	2,300	Secondary	Unsat.	Sat.	1,000	Enlarge	Inactive
Twelve Mile Creek	98.0								
Afton, Ia.	14.0	600	600	Minor[b]	Unsat.	Unsat.	400	Replace	Final plans approved
Weldon River	28.0								
Little River	35.0								
Leon, Ia.	24.0	1,800	2,400	Secondary	Sat.	Sat.	600	None	-
Princeton, Mo.	28.0	800	800	None	-	-	800	New plant	Inactive
Trenton, Mo.	26.0	2,800	2,800	None	-	-	2,800	New plant	Final plans approved
Tributary	60.0								
Chillicothe, Mo.	4.0	7,280	10,240	None	-	-	10,240	New plant	Final plans approved
Shoal Creek	58.0								
Lathrop, Mo.	65.0	740	940	Secondary	Unsat.	Sat.	220	Enlarge	Inactive
Branch	50.0								
Cameron, Mo.	5.0	1,090	2,490	Secondary	Unsat.	Sat.	350	Enlarge	Final plans approved. Under construction
Medicine Creek	50.0								
East Branch	32.0								
Allerton, Ia.	45.0	200	3,200	None	-	-	3,200	New plant	Final plans approved
Locust Creek	42.0								
East Branch Locust Creek	30.0								
Milan, Mo. (East Plant)	44.0	200	200	Minor[b]	Unsat.	Sat.	150	Addition	Plans under preparation
Milan, Mo. (South Plant)	44.0	500	2,300	Primary	Unsat.	Sat.	490	Addition	Plans under preparation
Yellow Creek	32.0								
East Yellow Creek	12.0								
Marceline, Mo. (West Plant)	10.0	1,400	1,400	Primary	Unsat.	Sat.	540	Addition	Plans under preparation
Elk Creek	3.0								
Brookfield, Mo.	20.0	4,200	4,400	Secondary	Sat.	Sat.	440	None	-
Brunswick, Mo.	5.0	990	1,740	None	-	-	1,740	New plant	Inactive
Chariton River	227.8								
Chariton, Ia. (S.W. Plant)	249.0	1,700	2,000	Secondary	Unsat.	Unsat.	800	Replace	Plans under preparation
South Chariton River	223.0								
Humeston, Ia.	30.0	500	500	Secondary	Unsat.	Sat.	150	Enlarge	Inactive
Branch	15.0								
Corydon, Ia.	10.0	1,200	1,200	Primary[c]	Unsat.	Unsat.	1,000	Replace	Inactive
Tributary	197.0								
Seymour, Ia. (East Plant)	21.0	630	630	Secondary	Sat.	Sat.	100	None	-
Centerville, Ia. (N.E. Plant)	4.0	5,000	5,500	Secondary	Unsat.	Unsat.	1,500	Addition	Inactive
Centerville, Ia. (West Plant)	4.0	2,200	2,200	Secondary	Unsat.	Unsat.	600	Addition	Inactive
Shoal Creek	172.0								
Seymour, Ia. (S.W. Plant)	40.0	80	80	Secondary	Sat.	Sat.	20	None	-
Blackbird Creek	148.0								
North Blackbird Creek	8.0								
Branch	20.0								
Unionville, Mo. (N. Plant)	5.0	300	300	Secondary	Unsat.	Unsat.	80	Addition	Inactive
Unionville, Mo. (S. Plant)	5.0	1,500	1,500	Secondary	Unsat.	Unsat.	700	Addition	Inactive
Puzzle Creek	36.0								
Salisbury, Mo. (N. Plant)	5.0	530	530	Primary	Unsat.	Unsat.	370	Addition	Final plans approved
Mussel Fork	31.0								
Clark Branch	12.0								
Locust Branch	11.0								
Marceline, Mo. (E. Plant)	2.0	1,000	1,000	Primary	Unsat.	Sat.	670	Addition	Plans under preparation
Little Chariton River	5.0								
East Fork	10.0								
Long Branch	40.0								
La Plata, Mo.	18.0	1,200	1,200	Secondary	Unsat.	Sat.	300	Enlarge	Inactive
Sweet Spring Creek	12.0								
Moberly, Mo. (West Plant)	15.0	3,000	3,000	Primary	Unsat.	Sat.	2,000	Addition	Plans under preparation
Middle Fork	10.0								
Branch	12.0								
Salisbury, Mo. (S. Plant)	1.0	530	530	Primary	Unsat.	Unsat.	370	Addition	Final plans approved
Totals		54,500	68,300				37,790		

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[1] Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

[2] The main stem of the Grand River above the junction with East Fork Grand River is also known as the West Fork Grand River.

[a] Four treatment plants.

[b] Septic tank.

[c] Three treatment plants.

Table GC-3. Grand-Chariton River Sub-Basin - Basic data on sources of industrial pollution—Industries discharging wastes directly to watercourses

Receiving stream, name and location of industry¹	River miles from mouth	Type of industry	Type of waste produced	Treatment or other pollution control measures: Degree	Treatment or other pollution control measures: Adequacy	Population equivalent (B.O.D.) discharged to watercourse	Needed works or equivalent control measures	Current status of industrial action
Missouri River								
Grand River	252.0							
Thompson River	44.0							
Three Mile Creek	90.0							
Afton Creamery Afton, Ia.	14.0	Food & kindred products	Organic	Minor	Inadequate	600	Replace	Inactive
Medicine Creek	53.0							
East Medicine Creek	32.0							
Milk Plant Allerton, Ia.	78.0	Food & kindred products	Organic	None	- -	3,000	New plant	Inactive
Locust Creek	48.0							
Muddy Creek	10.0							
Poultry Packing Plant Laclede, Mo.	3.0	Food & kindred products	Organic	Minor	Inadequate	550	Replace	Inactive
Chariton River	237.8							
Mussel Fork	31.0							
Long Branch Creek	24.0							
Poultry Packing Plant Bucklin, Mo.	10.0	Food & kindred products	Organic	None	-	750	New plant	Inactive
East Fork	3.0							
Sweet Springs Creek	12.0							
Meat Packing Plant Moberly, Mo.	15.0	Food & kindred products	Organic	Secondary	Adequate	(a)	None	-
Total						4,900		

[1] Industries having separate outlets.

[a] Land application - no discharge to watercourse.

JAMES RIVER SUB-BASIN

This section is based upon the report "James River Drainage Basin - A Cooperative State-Federal Report on Water Pollution" published April 1952. Data have been brought up-to-date as of January 1, 1953, by the State Health Departments of North Dakota and South Dakota.

General Description

The 22,100 square mile area of the James River Basin is divided between North Dakota (6,200 square miles) and South Dakota (15,900 square miles). The Basin is 350 miles long with a maximum width of about 100 miles. The river rises west of Fessenden, North Dakota, flows east for a short distance, and then follows a general southerly course through South Dakota to its confluence with the Missouri east of Yankton.

The Basin has a population of approximately 220,000. Jamestown, with 10,697 people (1950 census), is the largest community in the North Dakota section; six municipalities in North Dakota have populations in excess of 1,000. In South Dakota there are 14 communities with more than 1,000 inhabitants; Aberdeen has 21,051, Huron 12,788, and Mitchell 12,123.

The economy has developed upon an agricultural basis; the 1940 census shows 56 percent of employed workers were occupied in agricultural activities. Industry is related primarily to the processing of farm products. In 1940, sale of livestock amounted to 54 percent of total farm income. Raising of wheat and small grains predominates in the northern part of the Basin. Corn is the principal crop in the southern section.

Population growth appears dependent upon future development of agriculture and expansion of related industries. Irrigation has not been extensively practiced. Introduction of planned irrigation will result in new agricultural products and an intensification of some of the existing agricultural operations.

Water Uses

Many municipalities in the Basin utilize ground sources for water supply. Eighty communities serve daily 4,580,000 gallons of water secured from wells to over 59,000 people. Most wells have good yields; however, ground water levels in some areas have been declining and redrilling of wells has been necessary to insure adequate supplies. Aberdeen, Huron, and Mitchell, South Dakota, use surface sources to supply nearly 50,000 people with 5,500,000 gallons per day.

Natural ice harvesting is carried on near Huron and at Lake Mitchell.

Irrigation is as yet limited and relatively undeveloped. The authorized land and water resource development program offers tremendous possibilities. There are about 123,000 acres of irrigable land in the New Rockford and Sykeston Areas. About 12,000 acres of irrigable land along the James River are included in the Jamestown Pumping Areas. From Oakes, North Dakota, to Columbia, South Dakota, there are approximately 92,000 irrigable acres (Oakes Area) to be served by pumping from the James River.

Water for Oahe Unit would be pumped from Oahe Reservoir, now under construction on the Missouri River above Pierre, South Dakota, to potential Blunt Reservoir by way of the Pierre Canal. Flow from potential Blunt Reservoir would travel eastward through Ree Canal to Pony Hills Power Drop near Miller, generating 180,000 kilowatts of electrical energy for use in pumping irrigation water to an estimated 750,000 arable acres in the development unit. Scatterwood, Cresbard, Cottonwood, Sand Creek, and Firesteel Regulation Reservoirs are being considered for storage and regulation of irrigation waters. Return flows, water from the Missouri River, or a combination of both, would be used to serve irrigable acres in the Yankton-Vermillion area.

Numerous low head dams have been constructed across the "Jim" River and its tributaries to provide water for livestock. In addition, farmers and ranchers have built many small ponds to retain surface runoff for watering of animals. In North Dakota there are about 400 "dug-outs" and 450 dams. An average "dug-out" contains approximately one acre-foot of water and dams average about 5 acre-feet. The Agricultural Extension Service of the Soil Conservation Section at Fargo has found, in many cases, that livestock prefer water in dams and "dug-outs" to well water.

Recreational facilities are available in South Dakota at Richmond Lake; Lakes Louise, Iroquois, Osceola, Mitchell and Mina; and at Fisher Grove. Picnicking facilities are open to the public at Lakes Wilmarth, Faulkton, and Byron; Huron Memorial Park; and Hickman Dam. Hunting for small game is permitted at Lakes Osceola, Byron, and Wilmarth; Hickman Dam; Fisher Grove; and Forestburg State Recreational Areas. Excellent fishing has been experienced at Lake Louise on Wolf Creek. In addition, there are three national wildlife refuges, the Sand Lake in South Dakota, Dakota Lake and Arrowwood in North Dakota. Small recreational areas near Jamestown include Homer (5 acres), Fred Smith (2 acres), and Spiritwood Lake which is used extensively. The Pipestem Creek area, a short distance above Jamestown, may become important for recreational use.

Big game in the Basin is limited to white-tailed deer. Upland game is plentiful. The Basin is one of the most important waterfowl migration lanes in the country. Large numbers of blue and snow geese fly along this route each spring. White-fronted and Canada geese use this area during their flights in spring and fall. The marshy reaches along the river are used as nesting grounds for several species of ducks. Duck hunting is an important aspect of outdoor recreation in the Basin.

Low flow periods are generally critical because of the reduced volume of stream water available for use. The probable frequency of these low flow periods gives an indication of how often critical conditions may occur and provides a firm basis for the design of waste treatment installed to relieve crucial pollution. Critical oxygen depressions are more likely to take place during the summer time when high temperatures increase biological activity and reduce saturation limits of oxygen in water. Although cold weather conditions depress biological activity and increase oxygen saturation levels, the low stream velocity of the James is conducive to ice cover which prevents reaeration and causes oxygen depressions with concurrent nuisance conditions arising from decomposition of organic pollution. Low

Table J-1. James River Sub-Basin - Probable frequency of low mean monthly discharge

Summer (June-Sept)

Years of record	Stream and location	Miles to mouth James River	Miles to mouth Tributary	Drainage area square miles	Minimum monthly mean flows in cubic feet per second that may be expected once in: 2 years	3 years	5 years	10 years	Minimum
22	James River at Jamestown Damsite	582		-	3.0	1.8	1.4	1.2	0
22***	Jamestown Damsite	582		-	0	0	0	0	0
22	Pipestem Creek	578		750	0.5	0.3	0.2	0.2	0
22*	James River below mouth Pipestem Creek	577		2,740	3.0	1.2	0.6	0.6	0
10	James River at Jamestown, N.D.	577		2,740	1.3	0.8	0.8	0.7	0.7
4	James River at Columbia, S.D.	440		7,050	0.4	0.3	0.1	0	0
4	Elm River at Westport, S.D.	429	20	1,680	2.5	1.5	0.8	0.3	0.3
4	James River at Ashton, S.D.	310		11,000	4.6	0.18	0.08	0.05	0.02
4	Turtle Creek at Redfield, S.D.	290	2	1,940	0.1	0.05	0.03	0.03	0.03
15	James River at Huron, S.D.	223		15,800	1.0	1.2	1.0	0.08	0
21	James River at Scotland, S.D.	33		21,950	1.6	0.7	0.7	0.3	0

Fall (Oct-Nov)

Years of record	Stream and location	Miles to mouth James River	Miles to mouth Tributary	Drainage area square miles	Minimum monthly mean flows in cubic feet per second that may be expected once in: 2 years	3 years	5 years	10 years	Minimum
22	James River at Jamestown Damsite	582			0.8	0.6	0.5	0.4	0.3
22***	Jamestown Damsite	582			0	0	0	0	0
22	Pipestem Creek	578		750	0.6	0.3	0.3	0.3	0.2
22*	James River below mouth Pipestem Cr.	577		2,740	0.7	0.4	0.3	0.3	0.2
10	James River at Jamestown, N.D.	577		2,740	1.2	0.9	0.8	0.7	0.6
4	James River at Columbia, S.D.	440		7,050	0	0	0	0	0
4	Elm River at Westport, S.D.	429	20	1,680	4.3	1.3	0.7	0.7	0.7
4	James River at Ashton, S.D.	310		11,000	1.8	1.4	1.3	1.3	1.3
4	Turtle Creek at Redfield, S.D.	290	2	1,940	0.2	0.1	0.1	0.1	0.1
15	James River at Huron, S.D.	223		15,800	6.7	2.2	1.1	0.5	0
21	James River at Scotland, S.D.	33		21,950	7.6	5.2	0.9	0	0

Winter (Dec-Feb)

Years of record	Stream and location	Miles to mouth James River	Miles to mouth Tributary	Drainage area square miles	Minimum monthly mean flows in cubic feet per second that may be expected once in: 2 years	3 years	5 years	10 years	Minimum
22	James River at Jamestown Damsite	582			2.4	1.8	1.8	1.2	0.6
22***	Jamestown Damsite	582			0	0	0	0	0
22	Pipestem Creek	578		750	0.4	0.3	0.3	0.2	0.1
22*	James River below mouth Pipestem Creek	577		2,740	2.1	1.2	1.2	0.6	0.6
10	James River at Jamestown, N.D.	577		2,740	1.1	0.9	0.8	0.7	0.7
4	James River at Columbia, S.D.	440		7,050	0	0	0	0	-*
4	Elm River at Westport, S.D.	429	20	1,680	0.2	0.2	0.2	0	0
4	James River at Ashton, S.D.	310		11,000	0.1	0	0	0	0
4	Turtle Creek at Redfield, S.D.	290	2	1,940	0.3	0.3	0.2	0.2	0.2
12	James River at Huron, S.D.	223		15,800	3.1	1.9	1.1	0.6	0.5
19	James River at Scotland, S.D.	33		21,950	6.5	4.2	3.1	1.9	1.6

*Indicates reverse flow due to backwater effect of Elm River.

***Future flows below dam.

flows in the James River may be expected to occur at frequent intervals. Probable frequencies of low mean monthly flows during the summer, fall and winter seasons are shown in table J-1. These values are subject to modification on streams which are or will be subject to regulation by reservoir releases or will be influenced by return irrigation flows. It is of interest to note that minimum flows are, or approach, zero. Although these data have been greatly influenced by drought year records, the James River may be considered a stream deficient in firm, sustained stream discharges.

Sources of Pollution

Fifty-eight communities producing wastes having a population equivalent of 175,300 and 14 separately discharing industries with almost 16,500 population equivalents of organic pollution drain to the James River and its tributaries. Forty municipal treatment plants serving 89.2 percent of the sewered population reduces the waste discharged about 55 percent. Problems of municipal and industrial pollution are largely local in nature.

Public health hazards result from consumption of natural ice harvested in areas where untreated or inadequately treated wastes have been discharged to watercourses. Polluted waters are not considered satisfactory for livestock watering. Use of polluted waters in the irrigation of low-growing crops such as lettuce, berries, tomatoes, and other truck farm products is considered unsafe. Pollution data are tabulated in tables J-2 and J-3 and summarized in tables 1 and 2, Part I.

A minimum of efficient primary treatment is required in the Sub-Basin by State Water Pollution Control Agencies and, where water uses warrant, a higher degree of waste treatment is specified. Chlorination of treatment plant effluents may be required. Adequate treatment of municipal and industrial wastes reaching the James River and its tributaries would obviate local pollution problems and prevent public health hazards and nuisances.

The State Water Pollution Control Agencies are progressing in their programs to abate pollution by promoting new treatment facilities, enlargements, or additions to existing works. The public is being educated regarding effects of pollution. Additional funds and personnel are needed for proper execution of the program.

Municipal sewage treatment requirements are: 17 new plants, 4 replacements, and 16 enlargements. Ten industries require new treatment measures. Cost of constructing the recommended treatment facilities is conservatively estimated at $6,500,000, excluding interceptors, maintenance, and operation.

Table J-2. James River Sub-Basin - Basic data on sources of municipal pollution

Receiving stream, name, and location of municipality[1]	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) of untreated wastes	Waste treatment provided	Adequacy of treatment facilities Capy.	Adequacy of treatment facilities Oper.	Population equivalent discharged to watercourse	Project needs	Current status of municipal action
James River									
Fessenden, N. Dak.	688	700	700	Lagoon	Sat.	Sat.	(a)	None	-
New Rockford, N.Dak.	685	1,800	2,300	Minor[b]	Unsat.	Unsat.	2,320	Replace	Inactive
Kelly Creek	640								
Carrington, N.Dak.	21	1,800	2,880	Secondary	Sat.	Sat.	900	None	-
Jamestown, N.Dak.	587	9,800	12,080	Secondary	Unsat.	Unsat.	4,800	Replace	Final plans approved
Jamestown, State Hosp., N.Dak.	587	2,280	3,280	Secondary	Sat.	Sat.	600	None	-
Beaver Creek	555								
Streeter, N.Dak.	Landlocked	800	800	Primary	Sat.	Sat.	(400)[c]	None	-
Gackle, N.Dak.	50	500	800	Primary	Sat.	Sat.	380	None	-
LaMoure, N.Dak.	506	880	2,170	None	-	-	2,170	New plant	Inactive
Oakes, N. Dak.	484	1,480	3,380	None	-	-	3,320	New plant	Inactive
Elm River	429								
Maple River	48								
Kulm, N.Dak.	170	600	680	Primary	Sat.	Sat.	480	None	-
Edgeley, N.Dak.	85	800	1,410	Primary	Unsat.	Unsat.	1,080	Addition	Planning initiated
Ellendale, N.Dak.	15	1,800	2,480	Minor[b]	Unsat.	Sat.	2,250	Addition	Inactive
Frederick, S.Dak.	9	400	400	None	-	-	400	New plant	Inactive
Moccasin Creek	378								
Foot Creek	48								
Leola, S.Dak.	87	780	750	Primary	Unsat.	Unsat.	700	Replace	Inactive
Aberdeen, S.Dak.	43	20,000	30,320	Secondary	Sat.	Sat.	3,100	Addition	Inactive
Mud Creek	380								
Britton, S.Dak.	Landlocked	1,070	1,460	Secondary	Unsat.	Unsat.	(910)[c]	Addition	Inactive
Eden, S.Dak.	Landlocked	100	180	Primary	Sat.	Sat.	(70)[c]	None	-
Roslyn, S.D.	80	180	180	Secondary	Sat.	Sat.	120	None	-
Bristol, S.Dak.	Landlocked	600	1,000	Secondary	Sat.	Sat.	(200)[c]	None	-
Pierpont, S.Dak.	48	280	270	Primary	Sat.	Sat.	140	None	-
Andover, S.Dak.	43	220	220	None	-	-	220	New plant	Inactive
Groton, S.Dak.	46	1,080	1,800	None	-	-	1,800	New plant	Planning initiated
Ashton, S.Dak.	318	180	160	None	-	-	150	New plant	Inactive
Snake Creek	300								
West Branch	10								
Ipswich, S.Dak.	80	940	940	Secondary	Sat.	Sat.	140	None	-
[illegible] Creek	80								
Roscoe, S.Dak.	50	300	300	Secondary	Sat.	Sat.	380	None	-
Cresbard, S.Dak.	25	150	180	None	-	-	180	New plant	Inactive
Tributary	80								
Faulkton, S.Dak.	20	750	750	None	-	-	750	New plant	Planning initiated
Turtle Creek	292								
Highmore, S.Dak.	120	1,300	1,300	None	-	-	(1,300)[d]	None.	-
Miller, S.Dak.	98	1,470	2,280	Secondary	Sat.	Sat.	620	None	-
St. Lawrence, S.Dak.	90	380	380	Primary	Sat.	Unsat.	300	None	-
Cottonwood Lake	-								
Tributary	-								
Orient, S.Dak.	38	200	200	None	-	-	200	New plant	Planning initiated
Redfield, S.Dak.	2	2,200	2,660	Secondary	Unsat.	Unsat.	1,[illegible]00	Addition	Planning initiated
Redfield, State Home & School, S.D.	2	650	550	Secondary	Sat.	Unsat.	110	None	-
Frankfort, S.Dak.	280	300	300	None	-	-	300	New plant	Inactive
Foster Creek	248								
Clark, S.Dak.	47	1,400	2,170	Secondary	Sat.	Sat.	440	None	-
Thunder Creek	30								
Raymond, S.Dak.	18	300	300	None	-	-	300	New plant	Inactive
Huron, S.Dak.	222	12,000	42,700-(61,000)[e]	Secondary	Sat.[f]	Sat.	8,400-(18,400)[e]	Enlarge	Inactive
Sand Creek	214								
Wessington, S.Dak.	43	300	340	Secondary	Unsat.	Unsat.	100	Replace	Inactive
Wolsey, S.Dak.	41	400	400	None	-	-	400	New plant	Inactive
Pearl Creek	212								
South Fork	5								
Iroquois, S.Dak.	27	390	390	Primary	Unsat.	Unsat.	310	Addition	Inactive
Redstone Creek	188								
Willow Lake	-								
Willow Lake, S.Dak.	-	480	480	Primary	Sat.	Sat.	310	None	-
Carthage, S.Dak.	27	340	340	Primary	Sat.	Sat.	220	None	-
Woonsocket, S.Dak.	177	1,030	1,880	None	-	-	1,880	New plant	Inactive
Tributary	170								
Artesian, S.Dak.	10	420	610	None	-	-	610	New plant	Inactive
Firesteel Creek	139								
Wessington Springs, S.Dak.	90	1,480	2,080	Secondary	Unsat.	Sat.	2,180	Addition	Inactive
Mt. Vernon, S.Dak.	28	380	380	None	-	-	380	New plant	Inactive
Mitchell, S.Dak.	128	12,000	37,000	Secondary	Unsat.	Sat.	18,500	Addition	Inactive
Enemy Creek	131								
Plankinton, S.Dak.	67	740	740	Primary	Sat.	Sat.	480	Addition	Inactive
Plankinton, St. Train. School, S.D.	68	300	300	Secondary	Sat.	Sat.	60	None	-
Stickney, S.Dak.	Landlocked	350	350	Secondary	Sat.	Sat.	40	None	-
Pierre Creek	124								
Alexandria, S.Dak.	6	600	700	Primary	Unsat.	Unsat.	430	Addition	Inactive
Twelve Mile Creek	102								
[illegible] Creek	2								
Parkston, S.Dak.	16	1,380	2,340	Primary	Unsat.	Unsat.	1,330	Addition	Inactive
Wolf Creek	68								
Spencer, S.Dak.	47	380	380	Secondary	Sat.	Unsat.	380	Addition	Planning initiated
Emery, S.Dak.	32	480	480	Primary	Sat.	Unsat.	380	Addition	Inactive
Bridgewater, S.Dak.	23	700	940	None	-	-	940	New plant	Inactive
Dawson Creek	53								
Scotland, S.Dak.	6	1,220	2,420	Secondary	Sat.	Unsat.	1,350	Addition	Inactive
[illegible] Creek	28								
Menno, S. Dak.	6	820	1,280	Secondary	Unsat.	Sat.	600	Addition	Inactive
Beaver Creek	18								
Lesterville, S.Dak.	20	80	80	None	-	-	80	New plant	Inactive
Totals		98,880	175,280				78,980		

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[1] Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

[a] Discharge to an artificial lagoon--no outlet to watercourse.

[b] Septic tank.

[c] Discharge to slough--drainage to watercourse indefinite or nonexistent and primarily of local significance.

[d] Land application--pollution reaches watercourse only during wet weather.

[e] Including seasonal industrial wastes.

[f] Plant capacity is satisfactory under normal loading. Under heavier fall and early winter industrial discharges, plant efficiency may be greatly reduced.

Table J-3. James River Sub-Basin - Basic data on sources of industrial pollution - Industries discharging wastes directly to watercourses

Receiving stream, name, and location of municipality[1]	River miles from mouth	Type of industry	Type of waste produced	Treatment or other pollution control measures: Degree	Treatment or other pollution control measures: Adequacy	Population equivalent (B.O.D.) discharged to watercourse	Project needs	Current status of industrial action
James River								
Kelly Creek	640							
Carrington Sausage Co. Carrington, N.Dak.	21	Food and kindred products	Organic	Minor[a]	Adequate	(200)[b]	None	-
Neil's Meat Market Carrington, N.Dak.	21	Food and kindred products	Organic	Minor[a]	Adequate	(c)	None	-
Pipestem Creek	578							
Stock Sales Co. Jamestown, N.Dak.	2	Food and kindred products	Organic	None	-	400	New plant	Inactive
Orleans Canning Co. Jamestown, N.Dak.	1	Food and kindred products	Organic	Lagoon	Adequate	(d)	None	-
Railroad Shops Jamestown, N. Dak.	577	Transportation equipment	Organic & inorganic	None	-	100	New plant	Inactive
Moccasin Creek	378							
Foot Creek	45							
Langen Packing Co. Aberdeen, S.Dak.	4	Food and kindred products	Organic	None	-	(780)[e]	New plant	Inactive
Torigian Produce Co. Aberdeen, S.Dak.	6	Food and kindred products	Organic	None	-	(180)[e]	New plant	Inactive
H. W. Packing Co. Aberdeen, S.Dak.	4	Food and kindred products	Organic	None	-	(1,320)[b]	New plant	Inactive
Turtle Creek	282							
Jorgens Custom Butchering Redfield, S.Dak.	6	Food and kindred products	Organic	Minor[a]	Adequate	(c)	None	-
Lampes Packing Co. Huron, S.Dak.	221	Food and kindred products	Organic	None	-	480	New plant	Inactive
Tributary	137							
Rylan Meat Co. Mitchell, S.Dak.	2	Food and kindred products	Organic	None	-	(840)[b]	New plant	Inactive
Tributary	136							
Mitchell Packing Co. Mitchell, S.Dak.	1	Food and kindred products	Organic	None	-	(2,290)[b]	New plant	Inactive
Twelve Mile Creek	97							
Ethan Dairy Products Co. Ethan, S.Dak.	20	Food and kindred products	Organic	Minor[a]	Inadequate	(190)[b]	Replace	Inactive
South Fork	4							
Dimock Dairy Products Co. Dimock, S.Dak.	13	Food and kindred products	Organic	Minor[a]	Inadequate	(280)[b]	Replace	Inactive
Totals						7,060		

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[1] Industries having separate outlets.
[a] Septic tank.
[b] Discharge to an intermittent stream—pollution reaches watercourse only during high water.
[c] Sub-surface application—no waste reaches watercourse.
[d] Discharge to an artificial lagoon—no waste reaches watercourse.
[e] Discharge to slough—drainage to watercourse indefinite or nonexistent and primarily of local significance.

KANSAS RIVER SUB-BASIN

This section is based upon the report "Kansas River Drainage Basin-A Cooperative State-Federal Report on Water Pollution" published February 1953. Data are current as of January 1, 1953, as reported by the State Water Pollution Control Agencies of Colorado, Kansas, and Nebraska.

General Description

The Kansas River system drains an area of approximately 60,100 square miles, of which 16 percent is in northeast Colorado, 24 percent in southern Nebraska, and 60 percent in northern Kansas. Principal tributaries of the Kansas River include the Big Blue, Republican, and Smoky Hill Rivers. The Kansas River, a comparatively short stream flowing eastward 169 miles from Junction City to its confluence with the Missouri River at Kansas City, Kansas, has an average annual flow of about 8,000 c.f.s.

An estimated 1,200,000 people reside in the region. Kansas City, Kansas, with 130,000 people, is the largest city; other principal cities include Topeka, Manhattan, and Salina, Kansas; a portion of Kansas City, Missouri; McCook, Hastings, and Beatrice, Nebraska; and Burlington, Colorado.

The Basin's economy stems primarily from agriculture. Kansas City and Topeka are railroad and industrial centers and, with other municipalities, are focal points for collection and distribution of agricultural products. Large quantities of oil are produced principally in the headwater areas of the Solomon, Saline, and Smoky Hill Rivers.

Extreme droughts and devastating floods have stricken the area. Existing multiple purpose reservoirs are at Kanopolis and Cedar Bluffs, Kansas; Harlan County, Medicine Creek, and Enders, Nebraska; and Bonny, Colorado; more are proposed at other sites. In most instances the stream regulation program will insure a minimum flow consistent with reasonable sewage and industrial wastes treatment.

Water Uses

Principal uses of the streams include domestic and industrial water supplies, livestock watering, limited recreation and fishing, some irrigation, and removal and ultimate disposal of municipal sewage and industrial wastes. There are 16 existing hydroelectric power plants having an installed capacity of 6,300 kilowatts. Multiple purpose reservoirs have provided flood control, stored waters for irrigation, and created recreational sites.

Of the 310 municipal water supplies of the Basin, 12, or 4 percent, serving 144,210 people with 11,830,000 gallons per day, are obtained from surface sources. Surface water is used to serve power plants at Topeka, and Lawrence; for processing purposes at Sunflower Ordnance Depot; and for miscellaneous industries in Kansas City, Kansas. Two hundred ninety-eight community supplies from ground sources serve 355,960 persons 52,102,000 gallons daily.

Industrial use of water is exceedingly heavy in the lower Kansas River. Power plants at Topeka, and Lawrence require cooling water in excess of 200,000,000 gallons per day. Production at the Sunflower Ordnance plant is dependent upon an adequate volume of clean water. One plant located above Superior, Nebraska, on the Republican River has a water right to 11.5 second feet. Industrial water use approaches 250,000,000 gallons a day.

Prior to 1951 irrigation was practiced mainly in the headwater sections of the Republican River along Frenchman Creek and the North Fork of the Republican. Here water was pumped from ground sources or diverted from streams. Enders and Medicine Creek Reservoirs, on Frenchman and Medicine Creeks respectively, permit irrigation along the Republican River from McCook to Orleans, Nebraska, and development of these irrigation lands is progressing rapidly. Irrigation below Harlan County Dam will become a reality as canals now under construction are completed. Other areas considered suitable for irrigation lie below Trenton Dam along the Republican River, below Kanopolis and Cedar Bluffs Dams along the Smoky Hill River, along the Solomon River below proposed Kirwin, Webster, and Glen Elder Reservoirs, and below Bonny Dam on the South Fork of the Republican.

Streams are used for livestock watering and are also fished by local sportsmen. Reservoirs that have been constructed have created much needed fishing, boating, and swimming areas, their popularity being attested by the large numbers of people that have visited them since completion.

A study has been made of the probable frequency of low monthly flows and presented in table K-1. In computing the low mean monthly flow, the lowest monthly flow each year during the season of study was used. Low summer flows are of interest because of critical oxygen conditions that may occur during periods of high temperatures. Ice formation that prevents reaeration may cause low winter flows to be critical. Since sewage treatment is planned to provide reasonable protection to streams, low flow frequencies provide a firm foundation for treatment plant design.

Sources of Pollution

There are 171 sources of municipal pollution and 29 sources of separately sewered industrial pollution which contribute to Basin watercourses wastes having 1,500,000 population equivalents. These data are tabulated in tables K-2 and K-3 and summarized in tables 1 and 2, Part I.

Industrial plants in Topeka, Lawrence, and Kansas City, Kansas; and Kansas City, Missouri, discharge great quantities of organic matter. These include meat packing industries and the Kansas City, Missouri, garbage disposal station. Untreated industrial wastes of considerable magnitude also emanate from Red Cloud, Superior, Beatrice, and Fairbury, Nebraska; Manhattan and Lawrence, Kansas.

Salt brines originating in central Kansas in the drainage areas of the Smoky Hill, Solomon, and Saline Rivers contribute to deterioration of water quality. Much of the chloride content of these rivers is from

Table E-1. Kansas River Sub-Basin - Probable frequency of low mean monthly discharges

Years of Record	Stream and Location	Miles to mouth		Drainage Area Square Miles	Minimum monthly mean flows in cubic feet per second that may be expected once in:				
		Kansas River	Tributary		2 years	3 years	5 years	10 years	Minimum*
	SUMMER (JUNE-SEPT)								
	Kansas River								
16	Bonner Springs, Kans	80.2		59,887	2,920	1,730	1,170	970	466
26	Topeka, Kans	82.3		56,710	2,590	1,420	1,070	470	276
16	Wamego, Kans	123.6		55,235	2,050	1,180	850	500	278
16	Ogden, Kans	156.9		45,237	1,830	900	500	270	163
	Stranger Creek	33.6							
17	Tonganoxie, Kans		17.1	411	10	6	2	0	0
	Wakarusa River	40.7							
17	Lawrence, Kans		13.3	480	7	0.4	0	0	0
	Delaware River	63.3							
16	Valley Falls, Kans		30.6	922	18	13	4	3	1
	Soldier Creek	80.2							
17	Topeka, Kans		3.5	286	6	2	0.4	0	0
	Big Blue River	142.5							
16	Randolph, Kans		32.3	9,099	480	370	140	100	78
13	Barneston, Nebr		103.0	4,360	130	92	54	28	21
	Republican River	169.2							
16	Clay Center, Kans		42.1	24,570	400	300	205	60	2
15	Hardy, Nebr		145.1	22,410	370	202	52	30	16
13	Harlan County Reservoir, Nebr.		236.2	20,753	340	100	30	10	0
15	Culbertson, Nebr		351.9	7,897	19	3	1	0	0
15	Max, Nebr		385.6	7,188	83	9	2	1	1
	Prairie Dog Creek		239.8						
12	Norton, Kans		66.0	731	10	4	2	2	2
	Sappa Creek		256.0						
10	Oberlin, Kans		100.7	1,073	5	3	2	1	0
	Beaver Creek		12.3						
9	Beaver City, Nebr		24.7	1,964	13	4	2	1	0
	Medicine Creek		305.6						
8	Cambridge, Nebr		3.0	886	46	44	42	32	20
	Red Willow Creek		323.6						
6	Red Willow, Nebr		3.7	740	18	15	13	9	9
	Frenchman River (Creek)		351.6						
16	Hamlet, Nebr		32.1	2,386	74	72	71	69	63
	South Fork Republican River		393.6						
8	Benkelman, Nebr		3.6	2,721	1	0	0	0	0
	Bonny Dam Site, Nebr		56.9	1,875	10	8	6	3	0
	North Fork Republican River		421.7						
7	Wray, Colo		23.0	169	17	16	15	14	14
	Arikaree River		421.7						
14	Haigler, Nebr		0.6	1,934	3	2	2	2	2
	Smoky Hill River	169.2							
27	Salina, Kans		124.0	8,543	112	70	48	27	15
27	Lindsborg, Kans		170.9	8,112	100	62	31	21	12
27	Marquette, Kans		192.6	7,953	89	45	27	18	12
	Solomon River		95.4						
26	Niles, Kans		16.9	6,767	160	105	65	42	39
26	Minneapolis, Kans		55.8	6,039	120	88	43	27	23
26	Beloit, Kans		130.6	5,430	77	50	30	14	7
26	Glen Elder Dam site, Kans		156.1	5,076	72	46	26	13	7
	South Fork Solomon		171.6						
8	Alton, Kans		35.0	1,670	22	16	11	0.77	0.77
	Saline River		106.5						
16	Tescott, Kans		54.5	2,825	60	32	25	20	19

*Low Mean Month

Table K-1. Kansas River Sub-Basin - Probable Frequency of Low Mean Monthly Discharge

Years of Record	Stream and Location	Miles to mouth: Kansas River	Miles to mouth: Tributary	Drainage Area Square Miles	Minimum monthly mean flows in cubic feet per second that may be expected once in: 2 years	3 years	5 years	10 years	Minimum*
	WINTER (DEC - FEB)								
	Kansas River								
16	Bonner Springs, Kans	20.2		59,887	1,250	1,020	770	650	418
16	Topeka, Kans	82.3		56,710	1,070	805	650	540	368
16	Wamego, Kans	123.6		55,835	1,050	710	620	500	309
16	Ogden, Kans	158.9		45,257	590	490	350	290	119
	Stranger Creek	33.6							
17	Tonganoxie, Kans		17.1	411	9	5	3	2	0.5
	Wakarusa River	40.7							
17	Lawrence, Kans		13.3	400	3	1.5	0	0	0
	Delaware River	65.3							
16	Valley Falls, Kans		30.6	922	30	16	9	4	3
	Soldier Creek	80.2							
16	Topeka, Kans		3.5	286	7	4	1	0.2	0
	Big Blue River	142.5							
16	Randolph, Kans		32.3	9,099	270	250	200	185	179
13	Barneston, Nebr		103.0	4,360	130	125	110	90	68
	Republican River	169.2							
16	Clay Center, Kans		42.1	24,570	285	260	220	200	91
14	Hardy, Nebr		145.1	22,410	260	225	200	150	102
12	Harlan County Reservoir, Nebr		236.2	20,753	235	200	175	125	116
16	Culbertson, Nebr		351.9	7,897	155	120	71	60	56
15	Max, Nebr		395.6	7,188	150	105	82	64	60
	Prairie Dog Creek		237.0						
12	Norton, Kans		66.0	731	0	0	0	0	0
	Sappa Creek		258.0						
10	Oberlin, Kans		100.7	1,073	11	8	5	2	2
	Beaver Creek		12.3						
8	Beaver City, Nebr		26.7	1,564	1	0	0	0	0
	Medicine Creek		309.6						
8	Cambridge, Nebr		3.0	864	49	44	41	38	36
	Red Willow Creek		329.6						
6	Red Willow, Nebr		3.7	740	26	21	16	13	12
	Frenchman River (Creek)		351.6						
16	Hamlet, Nebr		32.1	2,386	98	90	82	76	70
	South Fork Republican River		393.6						
8	Benkelman, Nebr		3.6	2,721	41	28	18	12	10
10	Bonny Dam Site, Nebr		56.9	1,875	36	33	30	26	23
	North Fork Republican River		421.7						
7	Wray, Colo		23.0	469	22	22	22	21	21
	Arikaree River		421.7						
15	Haigler, Nebr		0.6	1,914	11	6	4	3	1
	Smoky Hill River	169.2							
26	Salina, Kans		124.0	8,263	50	30	27	20	15
26	Lindsborg, Kans		170.9	8,112	36	24	20	13	10
26	Marquette, Kans		192.4	7,953	35	22	17	11	6
	Solomon River		85.4						
25	Niles, Kans		16.9	6,767	52	42	30	22	18
25	Minneapolis, Kans		55.8	6,039	40	28	22	13	9
25	Beloit, Kans		130.6	5,430	30	15	11	5	2
25	Glen Elder Dam Site, Kans		156.1	5,076	26	15	9	4	2
	South Fork Solomon		171.6						
10	Alton, Kans		45.0	1,670	21	14	10	4	2.13
	Saline River		106.5						
16	Tescott, Kans		54.5	2,825	27	17	12	10	6

*Low Mean Month

natural salt deposits underlying the region, although brine pollution from the oil industry continues to be a factor. The oil industry has spent more than $15,000,000 to correct brine pollution.

Interstate pollution occurs in three river reaches where pollution discharged by Nebraska communities near the Nebraska-Kansas State line extends into Kansas. This occurs in the Republican, Blue, and Little Blue Rivers.

Municipal needs have been established for 48 new plants, 16 replacements, and 19 additions or enlargements; industries require new plants in 20 instances and 4 replacements. The cost of the recommended municipal and industrial waste treatment program is estimated at $24,000,000. This is a conservative figure and does not include the cost of providing trunk sewers, operation, or maintenance.

In the past six years new treatment plants have been provided at 22 municipalities. This is a tribute to the Water Pollution Control Agencies and to the people of the Basin. The State of Kansas, through the leadership of the State Board of Health, has been very active in this respect. Wise legislative action in Kansas has provided a background for rapid progress. Revision of statutes governing stream pollution control in Colorado and Nebraska is being studied by interested groups in those States.

Table B-6. Kansas River Sub-Basin - Basic data on sources of municipal pollution

Receiving stream and name and location of municipality	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) of untreated wastes produced	Waste treatment provided	Adequacy of treatment facilities Cap'y.	Adequacy of treatment facilities Degr.	Population equivalents discharged to watercourse	Project needs	Current status of municipal action
Kansas River									
Republican River (Tributary 169.2 miles above mouth of Kansas River)									
Landlocked									
Akron, Colo.	-	1,500	1,500	Primary	Sat.	Sat.	Land application	None	-
Yuma, Colo.	-	1,600	1,600	Lagoon	Sat.	Sat.	None (to lagoons)	None	-
North Fork Republican R.	421.7								
Wray, Colo.	19.1	2,100	1,900	Septic tank	Uns.	Uns.	1,800	Replace	No action
Benkelman, Nebr.	303.5	1,500	1,500	Primary	Uns.	Uns.	1,500	Replace	No action
South Fork Republican R.	303.6								
Flagler, Colo.	Landlocked	700	700	Secondary	Sat.	Sat.	140	None	-
St. Francis, Kansas	86.0	1,800	1,800	Secondary	Sat.	Sat.	320	None	-
Stratton, Nebr.	374.9	600	600	Secondary	Sat.	Sat.	210	None	-
Trenton, Nebr.	362.4	850	850	Secondary	Sat.	Sat.	300	None	-
Frenchman Creek	351.6								
Haxtun, Colo.	124.0	1,800	1,800	Primary	Uns.	Uns.	800	Replace	Under construction
Holyoke, Colo.	108.0	1,830	1,830	Primary	Uns.	Sat.	1,080	Enlarge	-
Landlocked									
Imperial, Nebr.		1,250	1,250	Secondary	Sat.	Sat.	620	None	-
Wauneta, Nebr.	42.3	900	900	None	-	-	900	New plant	No action
Palisade, Nebr.	23.6	500	500	Secondary	Sat.	Sat.	160	None	-
Stinking Water Creek	23.5								
Spring Creek	20.1								
Grant, Nebr.	32.0	600	600	Secondary	Sat.	Sat.	300	None	-
Madrid, Nebr.	Landlocked	800	800	Secondary	Sat.	Sat.	160	None	-
Culbertson, Nebr.	1.2	600	600	None	-	-	600	New plant	No action
McCook, Nebr.	339.3	7,900	14,300	Secondary	Sat.	Sat.	3,400	None	-
Indianola, Nebr.	325.8	700	700	Secondary	Sat.	Sat.	180	None	-
Medicine Creek	309.6								
Curtis, Nebr.	35.0	900	900	Secondary	Uns.	Sat.	250	Enlarge	No action
Cambridge, Nebr.	0.8	750	750	Secondary	Sat.	Sat.	220	None	-
Holbrook, Nebr.	300.5	400	400	Secondary	Sat.	Sat.	120	None	-
Muddy Creek	292.6								
Arapahoe, Nebr.	0.6	1,200	1,200	None	-	-	1,200	New plant	No action
Oxford, Nebr.	279.8	1,000	2,520	Secondary	Sat.	Sat.	760	None	-
Spring Creek	267.6								
Bertrand, Nebr.	23.0	300	300	Secondary	Sat.	Sat.	80	None	-
Sappa Creek	258.0								
North Fork Sappa Creek	107.8								
Goodland, Kansas	99.0	4,000	4,000	Secondary	Uns.	Sat.	1,100	Enlarge	Under construction [a]
South Fork Sappa Creek	107.8								
Brewster, Kansas	78.0	420	420	Primary	Sat.	Sat.	300	None	-
Oberlin, Kansas	100.8	1,430	1,780	Secondary	Sat.	Sat.	440	None	-
Beaver Creek	12.3								
Burlington, Colo.	236.2	2,200	2,200	Primary	Uns.	Sat.	1,400	Enlarge	No action
Atwood, Kansas	135.7	1,600	1,600	Secondary	Uns.	Uns.	1,000	Replace	No action
Herndon, Kansas	116.5	260	260	Secondary	Sat.	Uns.	60	None	-
Beaver City, Nebr.	18.8	900	900	Primary	Sat.	Sat.	400	None	-
Orleans, Nebr.	255.0	800	8,600	None	-	-	8,600	New plant	No action
Alma, Nebr.	247.0	1,700	1,700	Secondary	Sat.	Sat.	1,080	None	-
Republican City, Nebr.	240.0	800	800	Secondary	Sat.	Sat.	180	None	-
Prairie Dog Creek	239.8								
Colby, Kansas	157.0	3,500	3,500	Secondary	Uns.	Uns.	1,440	Enlarge	Preliminary report
Norton, Kansas	66.0	3,000	3,000	Secondary	Sat.	Uns.	660	None	-
State Sanitorium (Norton)	60.7	500	500	Secondary	Sat.	Sat.	120	None	-
Almena, Kansas	49.6	450	450	Secondary	Uns.	Uns.	400	Replace	No action
Turkey Creek	232.3								
Holdrege, Nebr.	40.0	4,300	7,200	Secondary	Sat.	Uns.	1,870	None	-
Franklin, Nebr.	218.4	1,600	1,600	None	-	-	1,600	New plant	No action
Red Cloud, Nebr.	186.7	1,700	4,850	None	-	-	4,850	New plant	No action
Superior, Nebr.	156.6	3,200	15,200	None	-	-	15,200	New plant	No action
Scandia, Kansas	125.2	900	900	None	-	-	900	New plant	Report prepared
Buffalo Creek	105.2								
Mankato, Kansas	35.2	1,150	1,150	Secondary	Uns.	Sat.	500	Replace	Report prepared
Jamestown, Kansas	15.0	300	300	Secondary	Sat.	Sat.	50	None	-
Concordia, Kansas	102.4	5,800	10,500	None	-	-	10,500	New plant	Preliminary report bonds voted
Salt Creek	90.7								
Belleville, Kansas	20.4	2,200	2,200	Secondary	Uns.	Sat.	1,100	Replace	Preliminary report
Clyde, Kansas	81.8	930	930	Primary	Uns.	Sat.	480	Enlarge	No action
Clifton, Kansas	69.5	300	610	Primary	Uns.	Uns.	540	Enlarge	No action
Tributary									
Linn, Kansas		500	1,000	Secondary	Sat.	Uns.	150	None	-
Clay Center, Kansas	42.1	4,400	6,600	None	-	-	6,600	New plant	Preliminary report
Wakefield, Kansas	25.7	500	500	None	-	-	500	New plant	Plans prepared
Junction City, Kansas	4.2	12,000	13,160	None	-	-	13,160	New plant	Under construction
Smoky Hill River	169.2								
Cheyenne Wells, Colo.	542.0	1,000	1,000	Primary	Uns.	Sat.	900	Replace	No action
Eagle Tail Creek	501.0								
Sharon Springs, Kansas		710	1,100	Secondary	Uns.	Sat.	480	Replace	Preliminary report
Hackberry Creek	378.2								
Oakley, Kansas	60.0	1,900	1,760	Secondary	Sat.	Sat.	300	None	-
Tributary									
McCracken, Kansas		350	350	Secondary	Sat.	Sat.	50	None	-
Big Creek	298.1								
Quinter, Kansas		400	400	Secondary	Sat.	Sat.	80	None	-
WaKeeney, Kansas	80.0	1,600	1,600	Secondary	Sat.	Sat.	300	None	-
Ellis, Kansas	44.0	1,900	2,000	Secondary	Sat.	Sat.	300	None	-
Hays, Kansas	25.0	6,400	7,810	Secondary	Uns.	Sat.	2,320	Enlarge	New plant No. 2 under construction
Fossil Creek	262.1								
Russell, Kansas	4.5	5,000	5,240	Secondary	Uns.	Sat.	1,520	Enlarge	Under construction
Wilson Creek	252.0								
Wilson, Kansas	2.5	700	2,050	Secondary	Uns.	Sat.	510	Enlarge	Under construction
Ellsworth, Kansas	238.3	1,650	2,060	Secondary	Sat.	Sat.	510	None	-
Marquette, Kansas	198.5	550	550	None	-	-	550	New plant	No action
Lindsborg, Kansas	167.4	1,700	1,880	Secondary	Sat.	Sat.	520	None	-
Salina, Kansas	123.5	22,000	31,900	Secondary	Sat.	Uns.	13,000	None	-
Saline River	106.5								
Paradise Creek	160.4								
Plainville, Kansas	45.0	1,750	1,880	Secondary	Sat.	Sat.	350	None	-
Tributary									
Lucas, Kansas[1]		-	-	Secondary	Sat.	Sat.	-	None	-
Sylvan Grove, Kansas	116.2	400	560	Secondary	Sat.	Sat.	140	None	-
Lincoln, Kansas	87.4	1,500	1,500	Secondary	Sat.	Sat.	380	None	-
Solomon River	85.4								
South Fork	171.6								
Bow Creek	148.0								
Hoxie, Kansas	8.0	900	1,320	Secondary	Sat.	Sat.	330	Addition	No action
Hill City, Kansas	118.0	950	1,180	Secondary	Sat.	Uns.	300	None	-
Stockton, Kansas	76.0	1,400	1,400	Secondary	Sat.	Sat.	350	None	-
Osborne, Kansas	26.1	1,800	1,800	None	-	-	1,800	New plant	Preliminary report

Table E-2, Kansas River Sub-Basin - Basic data on sources of municipal pollution (contd.)

Receiving stream and name and location of municipality	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) of untreated wastes	Waste Treatment provided	Adequacy of treatment facilities: Cap'y.	Adequacy of treatment facilities: Oper.	Population equivalents discharged to watercourse	Project needs	Current status of municipal action
Kansas River									
Smoky Hill River	169.2								
Solomon River	85.4								
North Fork	171.6								
Logan, Kansas	100.0	600	600	Secondary	Sat.	Sat.	190	None	-
Deer Creek	65.3								
Phillipsburg, Kansas	18.0	2,600	2,600	Secondary	Sat.	Uns.	800	None	-
Beaver Creek	45.1								
Smith Center, Kansas	14.4	1,450	1,950	Secondary	Sat.	Sat.	390	None	-
Gaylord, Kansas	42.9	170	170	Secondary	Sat.	Sat.	40	None	-
Downs, Kansas	11.5	1,200	1,330	None	-	-	1,330	New plant	No action
Beloit, Kansas	130.6	3,800	5,000	None	-	-	5,000	New plant	Preliminary report
Glasco, Kansas	98.7	650	800	None	-	-	800	New plant	Plans prepared
Delphos, Kansas	81.6	500	500	Secondary	Sat.	Sat.	100	None	-
Minneapolis, Kansas	55.8	1,650	2,300	None	-	-	2,300	New plant	No action
Solomon, Kansas	85.3	750	750	None	-	-	750	New plant	No action
Tributary									
Abilene, Kansas	64.8	5,200	8,300	Primary	Uns.	Sat.	4,200	Enlarge	No action
Enterprise, Kansas	55.4	700	700	None	-	-	700	New plant	Plans approved
Chapman, Kansas	37.8	700	970	None	-	-	970	New plant	Preliminary report
Chapman Creek	37.6								
Miltonvale, Kansas	46.0	500	500	Secondary	Sat.	Sat.	120	None	-
Lyons Creek	14.0								
Herington, Kansas	37.0	3,150	3,520	Secondary	Sat.	Sat.	260	None	-
West Fork Lyons Creek	27.0								
Hope, Kansas	10.0	400	400	Secondary	Sat.	Uns.	80	None	-
Fort Riley, Kansas	166.7	13,000	13,000	Secondary	Sat.	Sat.	5,900	None	-
Ogden, Kansas	158.9	450	450	None	-	-	450	New plant	No action
Manhattan, Kansas	144.1	20,000	26,200	None	-	-	26,200	New plant	Plans prepared
Big Blue River	142.5								
Davis Creek	277.0								
Polk, Nebr.	18.0	680	680	Secondary	Sat.	Sat.	220	None	-
Stromsburg, Nebr.	278.8	1,100	1,100	None	-	-	1,100	New plant	No action
Prairie Creek	257.7								
Osceola, Nebr.	6.0	980	980	Secondary	Sat.	Uns.	880	None	-
Shelby, Nebr.	258.3	380	340	Secondary	Sat.	Sat.	180	None	-
Beaver Creek	253.9								
David City, Nebr.	6.0	2,400	2,800	Secondary	Sat.	Uns.	800	None	-
Ulysses, Nebr.	244.0	300	300	None	-	-	300	New plant	No action
Staplehurst, Nebr.	236.0	200	200	Primary	Sat.	Sat.	130	None	-
Lincoln Creek	255.5								
Aurora, Nebr.	73.0	2,000	5,400	Secondary	Uns.	Sat.	1,600	Enlarge	No action
Seward, Nebr.	225.3	3,100	4,100	None	-	-	4,100	New plant	No action
Milford, Nebr.	204.0	900	900	None	-	-	900	New plant	No action
West Fork	192.1								
South Branch	36.1								
Hastings, Nebr.	76.7	20,000	25,700	Secondary	Uns.	Sat.	6,500	Enlarge	Under construction
School Creek	33.0								
Harvard, Nebr.	26.0	600	600	Secondary	Sat.	Uns.	120	None	-
Sutton, Nebr.	7.0	1,300	1,300	Secondary	Sat.	Sat.	200	None	-
Beaver Creek	36.1								
York, Nebr.	19.5	6,000	9,900	Secondary	Sat.	Uns.	4,850	None	-
Indian Creek	29.6								
Fairmont, Nebr.	28.0	750	750	Secondary	Sat.	Sat.	110	None	-
Beaver Crossing, Nebr.	29.0	300	300	Secondary	Uns.	Uns.	200	Replace	No action
Johnson Creek	11.7								
Exeter, Nebr.	25.0	550	550	Secondary	Sat.	Uns.	140	None	-
Crete, Nebr.	180.8	3,500	8,500	Secondary	Uns.	Sat.	2,550	Enlarge	No action
Swan Creek	176.8								
Dorchester, Nebr.	11.6	580	580	Secondary	Sat.	Sat.	170	None	-
Wilber, Nebr.	167.1	1,300	1,300	None	-	-	1,300	New plant	No action
Turkey Creek	150.8								
Geneva, Nebr.	53.0	1,000	1,000	Secondary	Sat.	Sat.	300	None	-
Friend, Nebr.	45.0	1,000	1,000	Secondary	Sat.	Uns.	200	None	-
DeWitt, Nebr.	4.2	400	400	Secondary	Sat.	Sat.	100	None	-
State Home (Beatrice, Nebr.)	130.0	2,000	2,000	Secondary	Sat.	Sat.	300	None	-
Beatrice, Nebr.	130.0	11,000	16,000	None	-	-	16,000	New plant	No action
Wymore, Nebr.	110.7	2,700	2,700	Secondary	Sat.	Sat.	800	None	-
Big Indian Creek	110.4								
Jansen, Nebr.	35.0	160	160	Secondary	Sat.	Uns.	30	None	-
Marysville, Kansas	80.0	3,800	6,700	None	-	-	6,700	New plant	No action
Little Blue River	61.8								
Minden, Nebr.	195.0	1,200	1,200	Secondary	Sat.	Sat.	360	None	-
Blue Hill, Nebr.	169.0	400	400	Secondary	Sat.	Sat.	100	None	-
Thirty-two Mile Creek	152.0								
Kenesaw, Nebr.	25.0	220	220	Secondary	Sat.	Uns.	50	None	-
Pawnee Creek	138.9								
Ingleside, Nebr.	27.0	2,000	2,000	Secondary	Sat.	Uns.	500	None	-
Dry Creek	133.4								
Lawrence, Nebr.	7.0	220	220	Secondary	Sat.	Sat.	20	None	-
Elk Creek	116.0								
Nelson, Nebr.	9.4	750	750	None	-	-	750	New plant	No action
Hebron, Nebr.	89.6	2,000	2,800	None	-	-	2,800	New plant	No action
Spring Creek	88.8								
Deshler, Nebr.	9.6	1,200	1,200	Secondary	Sat.	Sat.	360	None	-
Sandy Creek	68.1								
Edgar, Nebr.	49.0	800	800	Secondary	Sat.	Sat.	200	None	-
Davenport, Nebr.	40.0	250	250	Secondary	Sat.	Uns.	80	None	-
Little Sandy Creek	39.0								
Clay Center, Nebr.	37.0	800	800	Secondary	Sat.	Uns.	240	None	-
Dry Sandy Creek	11.0								
Bruning, Nebr.	14.0	120	120	Secondary	Sat.	Sat.	20	None	-
Fairbury, Nebr.	55.4	6,300	14,800	None	-	-	14,800	New plant	No action
Rose Creek	50.0								
Chester, Nebr.	32.0	250	250	Secondary	Sat.	Sat.	60	None	-
Mill Creek	30.9								
Washington, Kansas	22.3	1,100	1,360	Secondary	Sat.	Sat.	300	None	-
Hanover, Kansas	26.4	600	1,120	None	-	-	1,120	New plant	No action
Coon Creek	7.5								
Greenleaf, Kansas	24.0	600	600	Secondary	Sat.	Sat.	100	None	-
Waterville, Kansas	6.2	690	1,020	None	-	-	1,020	New plant	Report prepared
Blue Rapids, Kansas	59.5	1,200	2,090	None	-	-	2,090	New plant	Plans initiated
Black Vermillion River	48.3								
Nemaha Creek	24.4								
Axtell, Kansas	16.3	480	480	Secondary	Sat.	Sat.	120	None	-

Table 8-8. Kansas River Sub-Basin - Basic data on sources of municipal pollution (contd.)

Receiving stream and name and location of municipality^a	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) of untreated wastes	Waste Treatment provided	Adequacy of treatment facilities Cap'y.	Adequacy of treatment facilities Deg.	Population equivalents discharged to watercourse	Project needs	Current status of municipal action
Kansas River									
Big Blue River	142.5								
Black Vermillion River	48.1								
Frankfort, Kansas	12.0	1,100	1,600	None	-	-	1,600	New plant	Plans prepared
Wamego, Kansas	123.6	1,900	1,900	None	-	-	1,900	New plant	No action
Vermillion River	116.9								
Onaga, Kansas	25.0	700	700	Secondary	Uns.	Uns.	500	Replace	No action
St. Marys, Kansas	107.7	800	1,180	Primary	Uns.	Uns.	1,000	Replace	Preliminary report
St. Marys College St. Marys, Kansas	107.7	220	220	Septic tanks	Uns.	Sat.	20.	Replace	No action
Mill Creek	102.5								
Alma, Kansas	18.0	740	1,000	Secondary	Sat.	Sat.	250	Addition	Under construction[4]
Cross Creek	100.1								
Rossville, Kansas	3.0	500	500	Secondary	Sat.	Sat.	120	None	-
Kansas State Hospital		2,100	2,100	Secondary	Sat.	Sat.	300	None	-
Topeka, Kansas (Plant #1)	82.3	78,000	120,000	Secondary	Uns.	Sat.	30,000	Enlarge	Under construction
Topeka, Kansas (Plant #2)	82.3	5,800	5,800	Primary	Uns.	Sat.	4,350	Connect to Plant #1	No action
Topeka, Kansas (East End)	82.3	13,200	13,200	None	-	-	13,200	Connect to Plant #1	No action
Shunganunga Creek	73.9								
Forbes Air Base		8,000	8,000	Secondary	Uns.	Uns.	4,000	Addition	Under construction
Soldier Creek	80.2								
Kansas Technical Institute Topeka, Kansas	3.5	200	200	Secondary	Sat.	Sat.	40	None	-
Delaware River	63.3								
Walnut Creek	85								
Sabetha, Kansas (S.Plant)	15	1,000	5,500	Secondary	Sat.	Sat.	750	None	-
Grasshopper River	50.3								
Horton, Kansas	5.6	2,400	3,360	Secondary	Uns.	Sat.	750	Replace	Preliminary report
Elk Creek	42.6								
Holton, Kansas	11.6	2,900	4,020	Secondary	Sat.	Uns.	1,000	None	-
Delaware River	63.3								
Valley Falls, Kansas	29.7	1,050	1,960	None	-	-	1,960	New plant	No action
Lawrence, Kansas	50.2	23,000	31,000	None	-	-	31,000	New plant	Preliminary report
Eudora, Kansas	43.9	900	1,440	None	-	-	1,440	New plant	Plans prepared
Wakarusa River	40.7								
Haskell Institute Lawrence, Kansas		500	500	Secondary	Sat.	Sat.	80	None	-
Stranger Creek	33.4								
Tonganoxie Creek	16.0								
Tonganoxie, Kansas	3.1	1,000	1,000	Secondary	Uns.	Sat.	500	Replace	No action
DeSoto, Kansas	30.0	500	500	None	-	-	500	New plant	Plans prepared
Kill Creek	29.5								
Sunflower, Kansas	2.0	5,000	5,000	Secondary	Sat.	Sat.	1,250	None	-
Sunflower Ordnance Staff Village	2.0	200	200	Secondary	Sat.	Uns.	80	None	-
Sunflower Ordnance		7,000	7,000	Secondary	Sat.	Sat.	1,750	None	-
Bonner Springs, Kansas	20.2	1,850	1,850	None	-	-	1,850	New plant	Report prepared
Mill Creek	16.0								
Olathe, Kansas	12.0	5,500	5,500	Secondary	Uns.	Sat.	2,750	Replace	Part of improvements under construction
Grade and High Schools Turner, Kansas	9.6	1,110	1,110	None	-	-	1,110	New plant	No action
Turkey Creek	3.2								
Mission Township	3.0	32,000	32,000	Secondary	Uns.	Sat.	5,000	Enlarge	Under construction
Kansas City, Kansas[2]	3.0	38,000	153,100	None	-	-	153,100	New plant	Preliminary report in preparation
Kansas City, Mo.[3]	3.0	99,000	281,200	None	-	-	281,200	New plant	No action
Totals		646,640	1,088,830				779.450		

[1] New treatment plant completed September, 1952. House connections to sewers now under way.

[2] 71,000 population equivalents discharge, in addition, to the Missouri River.

[3] 106,900 population equivalents discharged, in addition, to the Missouri River, and 142,000 population equivalents discharge, in addition, to the Blue River.

[4] Construction completed since reporting date.

[a] Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

Table E-3. Kansas River Sub-Basin - Basic data on sources of industrial pollution—Industries discharging wastes directly to watercourses

Receiving stream, name and location of industry[1]	River miles from mouth	Type of industry	Type of waste produced	Treatment or other pollution control measures		Population equivalent (B.O.D.) discharged to watercourse	Project needs or equivalent control measures	Current status of industrial action
				Degree	Adequacy			
Kansas River								
Republican River	169.2							
Prairie Dog Creek	239.8							
Norton Ice & Meat Co. Norton, Kansas	66.0	Food products	Organic	Partial	Inadequate	100	Replace or other control measures	No action
Salt Creek	90.7							
Rendering Plant Belleville, Kansas	20.4	Food products	Organic	Secondary	Adequate	50	None	-
Smoky Hill River	169.2							
Big Creek	292.1							
Rendering Plant Ellis, Kansas	44.0	Food products	Organic	Major	Adequate	-	None	-
Slaughterhouse Ellsworth, Kansas	238.3	Food products	Organic	None	-	230	New plant or other control measures	No action
Solomon River	85.4							
North Fork	171.6							
Deer Creek	65.3							
Co-Op Oil Refinery Phillipsburg, Kansas	18.0	Petroleum products	Organic & inorganic	Partial	Adequate[2]	1,500	None	-
Patterson-Harwood Laboratory Manhattan, Kansas	144.1	Chemical products	Organic	None	-	2,670	New plants or connect to Manhattan sewers	No action
Dearborn Packing Plant Manhattan, Kansas	144.1	Food products	Organic	None	-	240		No action
Big Blue River	142.5							
Little Blue River	41.8							
Slaughterhouse Ayr, Nebraska	160.0	Food products	Organic	None	-	350	New plant or other control measures	No action
Black Vermillion River	48.1							
Rendering Plant Frankfort, Kansas	12.0	Food products	Organic	None	-	180	New plant or other control measures	No action
Soldier Creek	80.2							
Goodyear Tire Company Topeka, Kansas	2.0	Rubber products	Organic	Secondary[3]	Adequate	50	None	-
Delaware River	63.3							
Grasshopper Creek	60.0							
Rendering Plant Horton, Kansas	5.0	Food products	Organic	Major	Adequate	-	None	-
Mitchell Sausage Factory Valley Falls, Kansas	29.7	Food products	Organic	None	-	190	New plant or other control measures	No action
Lawrence Paper Company Lawrence, Kansas	50.2	Paper products	Organic	None	-	4,400	New plant or other control measures	No action
Stranger Creek	33.6							
Tonganoxie Creek	16.0							
Franklin Ice Cream Co. Tonganoxie, Kansas	3.1	Food products	Organic	Partial[4]	Inadequate	3,100	Replace or other control measures	No action
Kill Creek	29.5							
Sunflower Ordnance Sunflower, Kansas	2.0	Chemical	Inorganic	Major	Inadequate	-	Replace[5]	No action
Wolf Creek	21.0							
E. B. Rice Sausage Co. Bonner Springs, Kansas	2.0	Food products	Organic	None	-	290	New plant or other control measures	No action
Kuhn Cannery Bonner Springs, Kansas	20.2	Food products	Organic	Minor	Inadequate	13,400	Replace or other control measures	No action
Kansas City, Kansas[6]	3.0	Food, chemical, petroleum and miscellaneous products and services	Organic & Inorganic	None	-	579,900	New plant	Preliminary report
Total						719,730		

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[1] Includes only those industries having separate waste outlets.

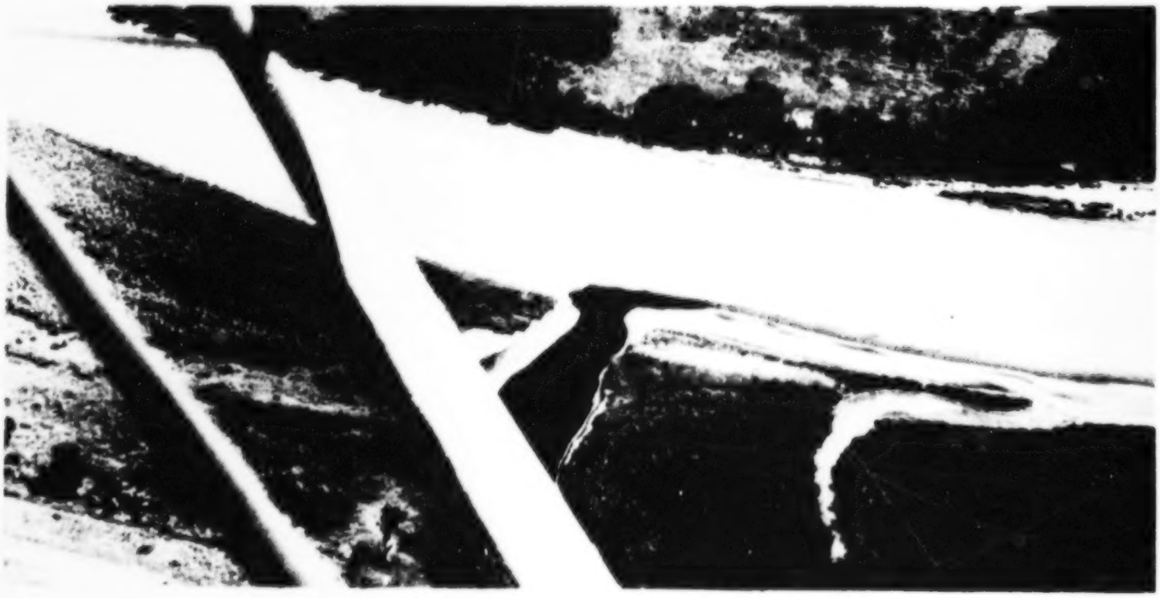
[2] Improved operation of existing oil separation equipment needed.

[3] Sanitary wastes only - Industrial wastes, consisting of rubber particles, not treated.

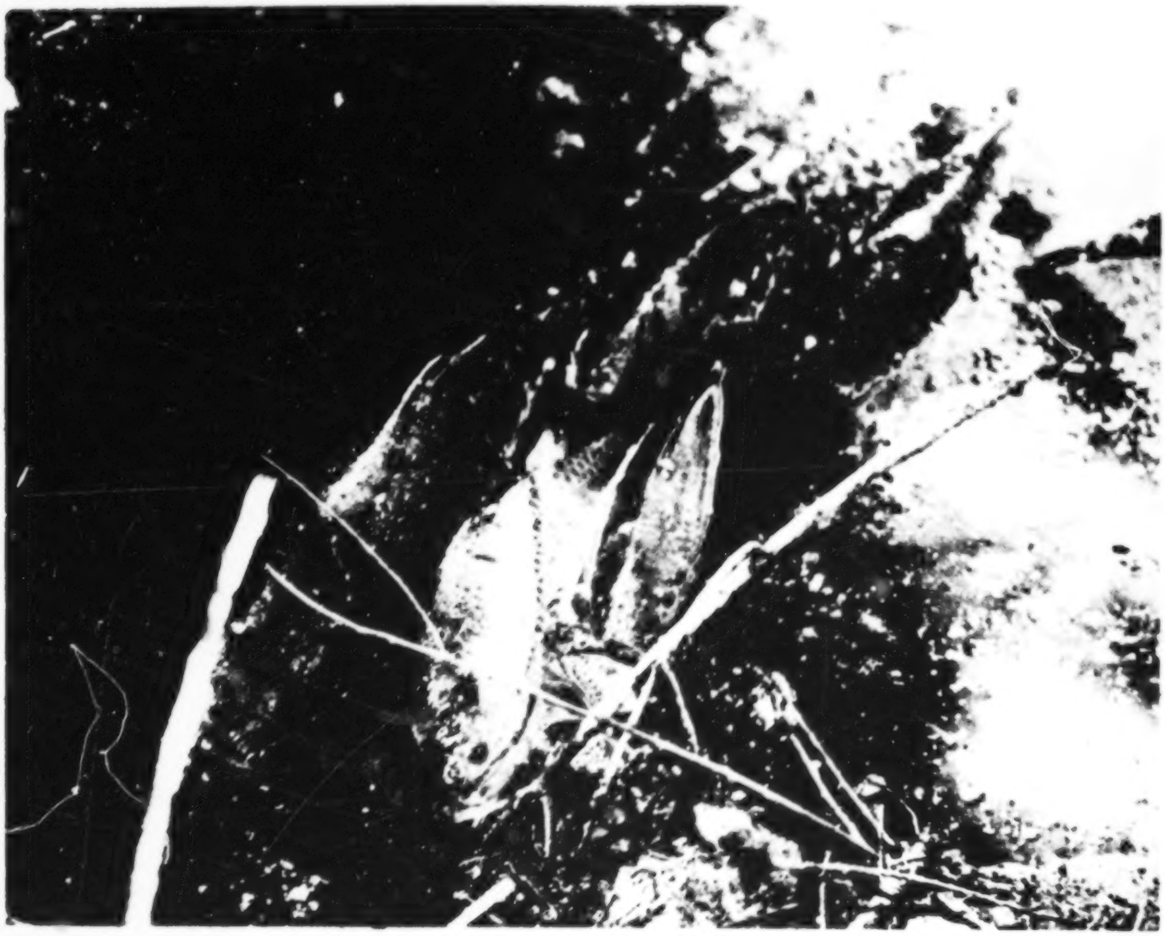
[4] Experimental plant provides unsatisfactory degree of treatment.

[5] Neutralization of acid wastes required.

[6] Includes 12 industries known to have separate outlets; 24,000 population equivalents in addition discharged to Missouri River.



The grossly polluted Blue River discharging to the Missouri



Fish attempting to survive in the [illegible] water trickle

LOWER MISSOURI RIVER SUB-BASIN

This section originates primarily from the report "Lower Missouri River Basin Water Pollution Investigation - A Cooperative State-Federal Report on Water Pollution" published October 1952. Factual data, as presented in this section, were made current to January 1, 1953, by the respective State Water Pollution Control Agencies of Iowa, Kansas, Minnesota, Missouri, Nebraska, and South Dakota.

General Description

The Lower Missouri River Sub-Basin, for purposes of this report, is that area drained by the Missouri River and its minor tributaries from the Niobrara River to the Mississippi. Major tributaries entering this reach, but not within the scope of this Sub-Basin, include the James, Big Sioux, Platte, Kansas, Grand, Chariton, Osage, and Gasconade Rivers. The Sub-Basin thus delimited is about 640 miles in length and 140 miles in maximum width. Parts of the States of South Dakota, Minnesota, Iowa, Nebraska, Kansas and Missouri are included in the 40,900 square mile drainage area.

The Lower Basin, roughly 8 percent of the Missouri River drainage area, has a population of 2,300,000, or 28 percent of the people in the Missouri watershed. Population density per square mile is 56 as compared to 15.5 for the entire Missouri watershed. Many of the larger cities in the Missouri valley are located here including Sioux City and Council Bluffs, Iowa; Omaha, Nebraska; St. Joseph and Kansas City, Missouri; and Atchison, Leavenworth, and Kansas City, Kansas.

As in other sections of the Missouri drainage area, agriculture is the chief occupation in the Lower Basin. Greater precipitation gives this area higher productivity and more consistent crop yields than the rest of the watershed. Most of the Sub-Basin is part of the Corn Belt. Corn, oats, wheat, grasses, legumes, and related crops are fed to cattle. In addition to beef, hogs, and poultry, dairy cattle are of great importance.

Manufacturing is of much greater importance here than elsewhere in the Missouri Basin. With the necessary raw materials so close at hand, large food handling and processing industries have been established in the larger cities. Some of the largest meat packing plants in the country are located at the Kansas Citys, St. Joseph, Omaha, and Sioux City.

Water Uses

The region generally has an ample supply of surface water. These waters are used as sources of domestic and municipal supplies, for industrial processing and cooling water, removal and ultimate disposal of industrial and domestic wastes, navigation, game and commercial fishing, recreation, limited irrigation, livestock watering, and support of wildlife.

The largest communities of the Sub-Basin, including Omaha, Council Bluffs, St. Joseph, Atchison, Leavenworth, and the Kansas Citys, derive their water supplies from the Missouri River as does St. Louis County and part of St. Louis. In addition, many smaller cities both along the main stem and tributaries depend on surface waters for their potable supplies. A total of 42 supplies use surface sources accommodating 1,860,000 people with 253.17 million gallons per day. Wells are used extensively with Sioux City being the largest community with a ground water supply. There are 316 municipalities using ground sources to serve 415,500 people with 36,760,000 gallons per day.

Industrial uses of water include processing, cooling, clean up, and air conditioning. Probably the largest single requirement is for cooling water at power plants, which is not a consumptive use as the water is returned to the stream generally unaltered except for a temperature increase. Yet water must be available at all times to permit uninterrupted operations. Industrial use of Missouri River water exceeds 1,146 million gallons per day. Fifty-eight industries tap ground water sources for 55,218,000 gallons each day.

Navigation in the Missouri River is authorized from Sioux City to the mouth and now exists between Omaha and the mouth. A 9-foot channel is maintained currently during the open water season by a minimum discharge of 30,000 second-feet at Sioux City, Iowa, which may, upon completion of the project, run as low as 25,000 second-feet under conditions of short supply. This water also satisfies other demands such as municipal and industrial water supplies, stream sanitation, and water for fish and wildlife needs. At present a moderate but increasing amount of freight moves by water between Kansas City and St. Louis.

Commercial fish are taken from the main stem of the Missouri, generally in the vicinity of river communities. The fish are sold locally.

Existing recreational facilities throughout the area are quite limited. The Missouri is a wild and treacherous river and does not tolerate much recreational encroachment in the form of pleasure boating or bathing. However, tributaries provide some opportunity for enjoyment of these sports. Of probably greater value is the relaxation and mental well-being achieved by viewing and absorbing the scenic grandour of the great and restless Missouri. Many people crowd the "highline" drives along the bluffs to view this mighty river and achieve a certain restfulness from the proximity of nature.

The land and water resource conservation program for the Missouri Basin includes consideration of water for stream sanitation, municipal use, irrigation, agricultural phases of land utilization and development, a 9-foot navigation channel from Sioux City to the mouth, and generation of hydroelectric power. Within the Lower Missouri River Sub-Basin itself, only one major impoundment is planned for the main stem; numerous smaller projects are being considered on tributary streams. This main stem dam--Gavins Point--under construction about four miles west of Yankton, is one of six multipurpose impoundments on the Missouri; the other five, which are situated above, in downstream sequence are existing Fort Peck; Garrison and Oahe, under construction; authorized Big Bend; and Fort Randall also under construction.

Water resources are seldom critical along the main river, except in times of extreme low flows. However, during these periods precarious situations have developed due to dependency placed upon water resources by large municipalities and industries. Stream regulation and low flow augmentation through the development program holds promise for alleviation of this condition.

A study of historic stream discharges was made to ascertain the probable future frequency of low flows. The results for summer, June - September, and winter, December - February, are presented in table LM-1. The minimum mean monthly flow for the seasonal periods for each year of record was selected and used as the basis for determinations. Probable low flow frequencies can be used as a basis to ascertain the degree of sewage treatment required to protect water uses and prevent nuisance conditions in streams. They are subject to modification on streams having, or which will have, comparatively large amounts of conservation storage.

In general, the data indicate that streams of the Sub-Basin have rather firm, dependable flows. Tributary streams, excluding the major sub-basins, are small to moderate in size and drain only limited areas. The Missouri River is controlled to a certain extent by Fort Peck Reservoir and will be further regulated when other main stem impoundments are completed. The data do not indicate daily or instantaneous minimum discharges that occur, especially when ice jams prevent normal flow conditions.

Sources of Pollution

There exists a total of 268 municipal sources of pollution and 73 industries having separate waste outlets. Municipal sewerage serves over 1,400,000 persons which, with connected industry, produces an estimated population equivalent of 2,899,000. Treatment at 174 municipalities serving 27 percent of the sewer-connected population reduces pollution by only 9.8 percent.

Industrial pollution discharged to streams is estimated at 1,689,000 population equivalents. Eighteen, or 24.7 percent, of the industries provide treatment of which one-half are reasonably adequate. Over-all industrial pollution reduction by treatment is estimated as 2 percent.

These data are tabulated in tables LM-2 and LM-3 and summarized in tables 1 and 2, Part I.

Communities on smaller streams where local nuisances frequently develop generally have provided some degree of treatment for their sewage. It appears that in larger streams, where downstream water uses only are affected, the need of sewage and waste treatment is less frequently recognized and accepted. The need, nonetheless, is there--urgent and real--and it must be brought before the citizens of these communities so that they may assume their obligations and provide for them.

None of the larger communities discharging sewage to the main stem provide treatment. Kansas City, Kansas, in compliance with the State Board of Health's comprehensive pollution control program of the Kansas Basin, has initiated action toward sewage treatment. Other municipalities on the main stem that have taken action that may lead to pollution abatement are Council Bluffs, Iowa; St. Joseph, Missouri; Leavenworth,

Table 10-1. Lower Missouri River Sub-Basin - Probable frequency of low mean monthly discharges

Years of record	Stream and location	Miles to mouth		Drainage Area Square Miles	Minimum monthly mean flows in cubic feet per second that may be expected once in:				
		Missouri River	Tributary		2 years	3 years	5 years	10 years	Minimum
	SUMMER (JUNE-SEPT)								
58	Missouri River at Sioux City, Ia.[1]	760.0		314,600	21,400	16,690	15,100	10,900	6,700
13	Floyd River at James, Ia.	758.3	9.5	918	24	16	9	7	6.9
16	Little Sioux River at Correctionville, Ia.	693.5	106.0	2,450	235	115	66	58	35.8
9	Little Sioux River near Kennebec, Ia.	693.5	19.5	2,730	164	126	98	83	74.2
8	Soldier River at Pisgah, Ia.	667.7	13.0	417	35	31	28	20	16.4
17	Boyer River at Logan, Ia.	651.0	31.3	810	135	66	47	15	7.6
18	Nishnabotna River above Hamburg, Ia.	560.6	10.9	2,800	336	200	107	46	16.8
17	E.Nishnabotna R. at Red Oak, Iowa		18.0 57	890	127	88	59	30	23.1
24	Tarkio River at Fairfax, Mo.	583.5	13.3	508	38	21	14	7	1.2
4	Nemaha River at Falls City, Nebr.	511.8	26.2	1,340	-	-	-	-	33.7
14	Nodaway River at Clarinda, Ia.	480.9	102.3	740	53	32	26	22	7.7
24	Nodaway River near Burlington Junction, Mo.	480.9	71.6	1,240	60	43	38	29	11.9
22	Platte River near Agency, Mo.	402.5	66.8	1,760	54	34	20	7	2.6
14	One Hundred and Two River near Maryville, Mo.		70.0 54	500	6	4	3	3	2.5
58	Missouri River at Kansas City, Mo.[1]	377.9		489,200	40,250	30,460	26,810	21,970	12,470
10	Blue River near Kansas City, Mo.	364.9	25.6	188	4	2	1	0.5	0.0
25	Lamine River at Clifton City, Mo.	202.2	39.3	538	18	10	8	6	0.0
22	Blackwater Creek at Blue Lick, Mo.		9.3 30.8	1,120	45	19	8	2	1.0
58	Missouri River at Hermann, Mo.[1]	96.9		528,200	52,100	47,640	33,460	27,380	18,200
	WINTER (DEC.-FEB.)								
58	Missouri River at Sioux City, Ia.[1]	760.0		314,600	9,750	8,120	7,470	6,860	3,740
13	Floyd River at James, Ia.	758.3	9.5	918	21	16	14	6	2.7
14	Little Sioux River at Correctionville, Ia.	693.5	106.0	2,450	122	112	90	51	21.5
9	Little Sioux River near Kennebec, Ia.	693.5	19.5	2,730	163	126	107	58	27.2
8	Soldier River at Pisgah, Ia.	667.7	13.0	417	27	15	11	8	6.3
15	Boyer River at Logan, Ia.	651.0	31.3	810	39	40	27	5	3.1
18	Nishnabotna River above Hamburg, Ia.	560.6	10.9	2,800	206	122	75	41	21.3
14	E. Nishnabotna River at Red Oak, Ia.		12.0 57	890	42	44	30	14	12.3
24	Tarkio River at Fairfax, Mo.	583.5	13.3	508	25	17	12	6	1.4
4	Nemaha River at Falls City, Nebr.	511.2	26.2	1,340	-	-	-	-	47.1
14	Nodaway River at Clarinda, Ia.	480.9	102.3	740	21	15	10	6	2.1
24	Nodaway River near Burlington Junction, Mo.	480.9	71.6	1,240	42	32	24	14	8.2
21	Platte River near Agency, Mo.	402.5	66.8	1,760	66	35	26	7	2.7
14	One Hundred and Two River near Maryville, Mo.		70.6 54	500	8	6	3	3	1.0
58	Missouri River at Kansas City, Mo.[1]	377.9		489,200	20,000	16,070	14,480	10,450	5,000
8	Blue River near Kansas City, Mo.	364.9	25.6	188	47	17	4	3	2.9
24	Lamine River at Clifton City, Mo.	202.2	39.3	538	75	48	27	13	6.5
21	Blackwater Creek at Blue Lick, Mo.		9.3 30.8	1,120	153	37	15	5	1.6
58	Missouri River at Hermann, Mo.[1]	96.9		528,200	30,900	27,560	21,070	17,570	6,830

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[1] Based on Flow Data from "Adequacy of Flows in the Missouri River", Missouri Basin Inter-Agency Committee - April 1951.

Wadsworth, Fort Leavenworth and the Federal Penitentiary at Leavenworth, Kansas. Other municipalities should take action, as sufficient data are available to define the sewage treatment needs. It must be remembered that almost 1,800,000 people are served with water secured from the Missouri River below sewage discharges.

Needs have been established for 97 new municipal plants, 48 replacements, and enlargements or additions in 33 instances. In addition, 54 industries discharging separately need new plants, 7 need replacements, and 3 require improvements. The cost of constructing the recommended treatment facilities is conservatively estimated at $82,400,000 which does not include interceptor sewers, maintenance or operation.

Interstate pollution is restricted primarily to the main stem of the Missouri. Most communities in the reach from Niobrara, Nebraska, to Kansas City, Kansas, contribute to interstate pollution.

Water pollution control agencies of the States concerned have good records. It is along the main stem of the Missouri, an interstate stream, that the lack of waste treatment is most noticeable, indicating a need for cooperative, unified action by the States concerned. A review of State laws denotes that utmost effort should be exerted in the States of Missouri and Nebraska to secure passage of comprehensive water pollution control laws.

Table [illegible]. Lower Missouri River Sub-Basin - Basic data on sources of municipal pollution

Receiving stream, name and location of municipality[a]	River miles above mouth: Missouri River	River miles above mouth: Tributary	Population served by sewers	Pop. equiv. (B.O.D.) industrial wastes to municipal sewers	Population equivalent (B.O.D.) untreated waste	Waste treatment provided	Adequacy of treatment facilities: Cap'y	Adequacy of treatment facilities: Oper.	Population equivalent discharged to watercourse	Project needs	Current status municipal action
Missouri River											
Niobrara, Nebr.	884		1,130	-	1,130	None	-	-	1,130	New plant	Inactive
Bazile Creek	880										
Creighton, Nebr.		35	1,200	-	1,200	Secondary	Sat.	Sat.	400	None	-
Little Bazile Creek		22									
Bloomfield, Nebr.		20	1,300	-	1,300	Primary	Unsat.	Unsat.	900	Addition	Inactive
Center, Nebr.		18	100	-	100	Secondary	Sat.	Sat.	30	None	-
Emanuel Creek	875.3										
Tripp, S. D.		48	1,000	-	1,000	Secondary	Sat.	Unsat.	300	None	-
Tyndall, S. D.		25	700	-	700	Primary	Unsat.	Unsat.	500	Replace	Inactive
Springfield, S. D.	873.3		670	30	700	None	-	-	700	New plant	Inactive
Yankton, S. D.	840.4		6,800	1,200	8,000	None	-	-	8,000	New plant	Inactive
Bow Creek	835										
[illegible] Creek		28									
Tributary		5									
Coleridge, Nebr.		8	650	-	650	Secondary	Sat.	Sat.	300	None	-
Hartington, Nebr.		35	1,800	-	1,800	Secondary	Sat.	Sat.	540	None	-
West Bow Creek		4									
Crofton, Nebr.		30	970	-	970	Secondary	Unsat.	Unsat.	600	Enlarge	Plans initiated
Vermillion Creek	806.1										
West Fork		70									
Howard, S. D.		88	1,000	-	1,000	Primary	Sat.	Unsat.	700	None	-
Salem, S. D.		68	1,000	-	1,000	Secondary	Unsat.	Unsat.	400	Replace	Inactive
Canistota, S. D.		38	600	-	600	Primary	Sat.	Unsat.	420	None	-
Marion, S. D.		14	700	-	700	Primary	Sat.	Sat.	490	None	-
Parker, S. D.		4	1,200	-	1,200	Secondary	Sat.	Unsat.	360	None	-
Tributary		56									
Hurley, S. D.		5	340	-	400	Primary	Sat.	Sat.	250	None	-
Long Creek		46									
Lennox, S. D.		16	800	-	800	Secondary	Sat.	Unsat.	200	None	-
Centerville, S. D.		40	900	-	900	Secondary	Sat.	Unsat.	140	None	-
Ash Creek		35									
Beresford, S. D.		15	1,800	-	1,800	Primary	Unsat.	Unsat.	1,000	Replace	Inactive
East Fork		70									
De Smet, S. D.		(b)	600	-	600	Primary	Sat.	Sat.	450	None	-
Turkey Ridge Creek		30									
Freeman, S. D.		84	400	100	500	Primary	Unsat.	Sat.	350	Addition	Inactive
Viborg, S. D.		9	800	180	980	Secondary	Sat.	Sat.	150	None	-
Vermillion, S. D.		5	2,700	300	3,000	None	-	-	3,000	New plant	Inactive
Elk Point, S. D.	790.1		1,380	-	1,380	None	-	-	1,380	New plant	Inactive
Aowa Creek	774										
North Aowa Creek		8									
Newcastle, Nebr.		13	420	-	420	Secondary	Sat.	Unsat.	200	None	-
Ponca, Nebr.		6	1,080	-	1,080	None	-	-	1,080	New plant	Inactive
South Sioux City, Nebr.	760		5,800	-	5,800	None	-	-	5,800	New plant	Inactive
Sioux City, Ia.	760		70,000	16,100	86,100[c]	None	-	-	86,100	New plant	Inactive
Floyd River	758.5										
Sheldon, Ia.		74	3,750	-	3,750	Secondary	Sat.	Sat.	900	None	-
Nameless Creek		72									
Sanborn, Ia.		14	1,200	-	1,200	Secondary	Unsat.	Unsat.	900	Replace	Plans initiated under orders
Hospers, Ia.		48	400	1,300	1,700	Minor[d]	Unsat.	Unsat.	1,300	Replace	Plans approved
Alton, Ia.		52	900	100	1,000	Secondary	Unsat.	Unsat.	380	Replace	Plans initiated
Deep Creek		32.9									
Remsen, Ia.		12	1,130	-	1,130	Secondary	Sat.	Sat.	300	None	-
Willow Creek		4									
Granville, Ia.		19	300	-	300	Secondary	Sat.	Unsat.	200	None	-
Le Mars, Ia.		32.9	5,800	1,000	6,800	None	-	-	6,800	New plant	Inactive
West Branch		25									
Boyden, Ia.		38	450	480	930	Secondary	Unsat.	Unsat.	300	Enlarge	Inactive
Sioux Center, Ia.		38	1,600	2,200	3,800	Secondary	Unsat.	Unsat.	2,000	Enlarge	Plans approved
Maurice, Ia.		19	280	-	280	Primary	Unsat.	Sat.	180	Addition	Inactive
Nameless Creek		16.5									
Orange City, Ia.		11	2,100	-	2,100	Secondary	Sat.	Sat.	600	Addition	Inactive
Merrill, Ia.		22	400	-	400	None	-	-	400	New plant	Inactive
Hinton, Ia.		14.8	300	-	300	None	-	-	300	New plant	Inactive
Dakota City, Nebr.	753.6		-	-	-	-	-	-	-	-	Plans for sewers initiated
Omadi Ditch	746										
Omaha Creek		4.5									
Walthill, Nebr.		17	1,000	-	1,000	None	-	-	1,000	New plant	Inactive
North Omaha Creek		15									
Emerson, Nebr.		16	800	80	880	Secondary	Sat.	Sat.	300	None	-
Winnebago, Nebr.		6	390	-	390	None	-	-	390	New plant	Inactive
Decatur, Nebr.	718.9		680	-	680	Secondary	Sat.	Sat.	170	None	-
Monona-Harrison Ditch	693.5										
Onawa, Ia.		6	3,000	-	3,000	Secondary	Sat.	Sat.	880	None	-
Little Sioux River	685.5										
Nameless Creek		315									
Lakefield, Minn.		15	Ditch to Heron Lake (outside sub-basin)								
West Fork		270									
Round Lake, Minn.		36	-	-	-	-	-	-	-	-	Plans approved for sewer system and treatment plant
Tributary		11									
Lake Park, Ia.		5	900	400	1,300	Secondary	Unsat.	Unsat.	900	Replace	Plans initiated
Nameless Creek		286									
Orleans, Ia.) Spirit Lake, Ia.) Okoboji, Ia.) Arnolds Park, Ia.)		6	30,000[e]	-	30,000	Secondary	Unsat.	Sat.	7,000	Enlarge	Plans initiated
Milford, Ia.		3	1,000	100	1,100	Secondary	Unsat.	Unsat.	550	Replace	Plans initiated
Ocheyedan River		257									
Ocheyedan, Ia.		42	600	-	600	Secondary	Unsat.	Sat.	300	Addition	Inactive
Nameless Creek		34									
Harris, Ia.		15	250	50	300	Secondary	Sat.	Unsat.	100	None	-
Hartley, Ia.		22	1,600	2,100	3,700	Secondary	Sat.	Sat.	550	None	-
Everly, Ia.		12	600	-	600	Primary	Sat.	Unsat.	380	Addition	Inactive
Spencer, Ia.		227	7,000	2,000	9,000	Secondary	Sat.	Sat.	1,000	None	-
[illegible], Ia.		225	800	500	1,300	Secondary	Sat.	Unsat.	600	Replace	Inactive
Sioux Rapids, Ia.		191	900	-	900	None	-	-	900	New plant	Plans approved
Linn Grove, Ia.		181	300	-	300	None	-	-	300	New plant	Plans approved
Peterson, Ia.		172	600	-	600	Secondary	Sat.	Sat.	150	None	-

Table 18-2. Lower Missouri River Sub-Basin - Basic data on sources of municipal pollution (cont.)

Receiving stream, name and location of municipality[a]	River miles above mouth: Missouri River	River miles above mouth: Tributary	Population served by sewers	Pop. equiv. (B.O.D.) industrial wastes to municipal sewers	Population equivalent (B.O.D.) untreated waste	Waste treatment provided	Adequacy of treatment facilities: Cap'y	Adequacy of treatment facilities: Oper.	Population equivalent discharged to watercourse	Project needs	Current status municipal action
Missouri River											
Little Sioux River	669.2										
Waterman Creek		167									
Sutherland, Ia.		8	850	1,150	2,000	Secondary	Unsat.	Unsat.	500	Replace	Plans initiated
Mill Creek		147									
West Fork		37									
Primghar, Ia.		8	1,000	-	1,000	Secondary	Unsat.	Unsat.	750	Replace	Plans initiated
Paullina, Ia.		24	1,000	600	1,600	Minor[a]	Unsat.	Unsat.	1,000	Replace	Plans approved
Cherokee, Ia.		144	6,800	-	6,800	Secondary	Sat.	Sat.	1,300	None	-
Cherokee, Ia., State Hospital		144	2,000	-	2,000	Secondary	Sat.	Sat.	400	None	-
Quimby, Ia.		130	330	-	330	Secondary	Sat.	Unsat.	100	None	-
Washta, Ia.		121	350	-	350	Secondary	Sat.	Sat.	100	None	-
Pierson Creek		106									
Pierson, Ia.		6	400	-	400	Secondary	Sat.	Unsat.	300	None	-
Correctionville, Ia.		106	900	-	900	Primary	Unsat.	Sat.	800	Addition	Inactive
Bacon Creek		105									
Cushing, Ia.		8	200	-	200	Secondary	Sat.	Sat.	40	None	-
Anthon, Ia.		79	700	-	700	Secondary	Unsat.	Sat.	450	Replace	Inactive
Wolf Creek		38									
West Fork		6									
Marcus, Ia.		62	1,200	-	1,200	Secondary	Unsat.	Unsat.	900	Replace	Inactive
Kingsley, Ia.		49	900	-	800	Secondary	Unsat.	Unsat.	600	Replace	Inactive
Moville, Ia.		30	870	-	870	Minor[a]	Unsat.	Unsat.	700	Replace	Inactive
Maple River		13									
Aurelia, Ia.		77	780	-	780	Secondary	Unsat.	Unsat.	600	Replace	Plans initiated
Nameless Creek		63									
Alta, Ia.		13	1,150	450	1,600	Secondary	Sat.	Sat.	300	None	-
Nameless Creek		60									
Schaller, Ia.		9	700	-	700	Secondary	Sat.	Sat.	150	None	-
Galva, Ia.		3	400	-	400	Secondary	Sat.	Sat.	100	None	-
Odebolt Creek		44									
Odebolt, Ia.		12	1,250	-	1,250	Secondary	Unsat.	Unsat.	900	Replace	Plans approved
Arthur, Ia.		7	200	-	200	None - abandoned	-	-	200	New plant	Inactive
Ida Grove, Ia.		44	1,800	-	1,800	Secondary	Sat.	Sat.	450	None	-
Battle Creek		33									
Holstein, Ia.		12	1,250	-	1,250	Secondary	Sat.	Sat.	300	None	-
Battle Creek, Ia.		33	550	-	550	None	-	-	550	New plant	Inactive
Danbury, Ia.		33	800	-	800	None	-	-	800	New plant	Inactive
Mapleton, Ia.		14	1,400	800	2,200	Secondary	Unsat.	Unsat.	1,600	Replace	Inactive
Tekamah Diversion	669										
Tekamah Creek		7.5									
Tekamah, Nebr.		0.2	1,800	-	1,800	Secondary	Sat.	Sat.	450	None	-
Soldier River	667.7										
East Fork		41									
Schleswig, Ia.		18	800	-	800	Secondary	Sat.	Sat.	150	None	-
Charter Oak, Ia.		8	650	-	650	Secondary	Sat.	Unsat.	550	None	-
Nameless Creek		2.6									
Ricketts, Ia.		6	100	-	100	Primary	Sat.	Unsat.	60	Addition	Inactive
Ute, Ia.		41	400	-	400	Secondary[b]	Sat.	Unsat.	400	None	-
Cameron Ditch	670.0										
Blair Creek		0.6									
Blair, Nebr.		2	3,290	-	3,290	None	-	-	3,290	New plant	Inactive
Boyer River	651										
Early, Ia.		126	600	-	600	Secondary	Unsat.	Unsat.	400	Replace	Inactive
Wall Lake, Ia.		107	640	-	640	Secondary	Unsat.	Unsat.	550	Replace	Plans approved
Otter Creek		88									
Kiron, Ia.		10	280	-	280	Secondary	Sat.	Sat.	60	None	-
Denison, Ia.		82	4,000	-	4,000	None	-	-	4,000	New plant	Inactive
East Fork		62									
Westside, Ia.		16	300	-	300	Primary	Sat.	Sat.	200	Addition	Inactive
Vail, Ia.		9	350	-	350	None	-	-	350	New plant	Inactive
Dow City, Ia.		48	400	100	500	None	-	-	500	New plant	Inactive
Dunlap, Ia.		60	1,200	-	1,200	None	-	-	1,200	New plant	Inactive
Woodbine, Ia.		46	1,000	-	1,000	None	-	-	1,000	New plant	Inactive
Logan, Ia.		31.5	1,400	600	2,000	None	-	-	2,000	New plant	Inactive
Willow Creek		11.6									
Missouri Valley, Ia.		7	3,200	-	3,200	None	-	-	3,200	New plant	Inactive
Carter Lake, Ia.	633		900	-	900	None	-	-	900	New plant	Inactive
Council Bluffs, Ia.	632		43,800	3,350	47,150	None	-	-	47,150	New plant	Plans approved
Omaha, Nebr.	631.4		180,000[c]	1,100,770	1,280,770	None	-	-	1,280,770	New plant	Inactive
Mosquito Creek	622.5										
Neola, Ia.		36	700	-	700	Secondary	Sat.	Unsat.	550	Addition	Inactive
Iowa School for Deaf		9	400	-	400	None	-	-	400	New plant	Inactive
Bellevue, Nebr.	614.1		2,000	-	2,000	None	-	-	2,000	New plant	Inactive
Big Papillion Creek	613.6										
Bennington, Nebr.		41	350	-	350	None	-	-	350	New plant	Inactive
Ralston, Nebr.		16	900	-	900	None	-	-	900	New plant or connect to Omaha sewers	Inactive
Little Papillion Creek		14									
Omaha, Nebr.		0.5	60,000	-	60,000	Secondary	Unsat.	Sat.	18,000	Enlarge	Inactive
West Papillion Creek		10									
West Branch		21									
Elkhorn, Nebr.		5	450	-	450	Minor[a]	Unsat.	Unsat.	450	Replace	Inactive
Millard, Nebr.		13	150	-	150	Secondary	Sat.	Unsat.	50	None	-
Hell Creek		6									
Boys Town, Nebr.		9	1,800	-	1,800	Secondary	Sat.	Sat.	350	None	-
Papillion, Nebr.		5	700	-	700	None	-	-	700	New plant	Inactive
Fort Crook, Nebr.		7.6	6,000	-	6,000	Secondary	Sat.	Sat.	900	None	-
Plattsmouth, Nebr.	597.6		4,000	21,410	25,410	None	-	-	25,410	New plant	Inactive
Keg Creek	594.6										
Glenwood, Ia.		11	2,800	-	2,800	None	-	-	2,800	New plant	Plans approved
Glenwood, Ia., State School			2,000	-	2,000	Secondary	Sat.	Sat.	500	None	-
Plum Creek	590.5										
Tabor, Ia.		16	800	-	800	Secondary	Unsat.	Unsat.	600	Replace	Inactive
Weeping Water Creek	588.6										
Weeping Water, Nebr.		28	750	-	750	Secondary	Sat.	Sat.	200	None	-
Nebraska City, Nebr.	579.5		5,000	14,200	19,200	None	-	-	19,200	New plant	Inactive
Drainage Ditch	561.0										
Peru, Nebr.		2	1,000	-	1,000	Secondary	Sat.	Sat.	250	None	-
Nishnabotna River	560.6										
West Nishnabotna River		13									
Manning, Ia.		127.5	1,600	280	1,880	Secondary	Sat.	Sat.	300	None	-

Table 13-2. Lower Missouri River Sub-Basin - Basic data on sources of municipal pollution (cont.)

Receiving stream, name and location of municipality[a]	River miles above mouth: Missouri River	River miles above mouth: Tributary	Population served by sewers	Pop. equiv. (B.O.D.) industrial wastes to municipal sewers	Population equivalent (B.O.D.) untreated waste	Waste treatment provided	Adequacy of treatment facilities: Des'n	Adequacy of treatment facilities: Oper.	Population equivalent discharged to watercourse	Project needs	Current status municipal action
Missouri River											
Nishnabotna River	560.8										
West Nishnabotna River		12									
West Fork		101									
Manilla, Ia.		15	1,000	-	1,000	Secondary	Unsat.	Sat.	750	Replace	Inactive
Harlan, Ia.		101	3,520	480	4,000	Secondary	Sat.	Sat.	800	None	-
East Branch		86									
Avoca, Ia.		4	1,800	1,000	2,800	None	-	-	2,800	New plant	Plans approved
Hancock, Ia.		76.1	220	-	220	Primary[b]	Sat.	Unsat.	220	Addition	Inactive
Oakland, Ia.		70	1,000	-	1,000	None	-	-	1,000	New plant	Inactive
Carson, Ia.		64	400	-	400	None	-	-	400	New plant	Inactive
Indian Creek		40									
Emerson, Ia.		7	480	-	480	Secondary	Sat.	Sat.	100	None	-
Silver Creek		32									
Shelby, Ia.		48	480	-	480	Secondary	Sat.	Sat.	50	None	-
Malvern, Ia.		5	1,280	720	2,000	None	-	-	2,000	New plant	Plans approved
Walnut Creek		7									
Walnut, Ia.		8	800	-	800	Secondary	Sat.	Sat.	200	None	-
Sidney, Ia.		5	1,000	-	1,000	Secondary	Sat.	Sat.	250	None	-
East Nishnabotna River		12									
Troublesome Creek		115									
Audubon, Ia.		10	2,400	-	2,400	Secondary	Sat.	Sat.	240	None	-
Exira, Ia.		114	750	1,050	1,800	Secondary	Unsat.	Unsat.	(1,800)[f]	Addition	Inactive
Atlantic, Ia.		98.4	5,800	-	5,800	Secondary	Sat.	Sat.	580	None	-
Turkey Creek		97									
Anita, Ia.		19	900	-	900	None	-	-	900	New plant	Inactive
Griswold, Ia.		75	800	-	800	Secondary	Sat.	Sat.	200	None	-
Elliott, Ia.		68	480	-	480	None	-	-	480	New plant	Inactive
Red Oak, Ia.		57	5,600	-	5,600	None	-	-	5,600	New plant	Inactive
Essex, Ia.		54	680	-	680	None	-	-	680	New plant	Inactive
Shenandoah, Ia.		27.2	6,500	800	7,300	None	-	-	7,300	New plant	Inactive
Farragut, Ia.		7	380	-	380	None	-	-	380	New plant	Inactive
Hamburg, Ia.		6	1,800	-	1,800	None	-	-	1,800	New plant	Inactive
Little Nemaha River	544.6										
Syracuse, Nebr.		42	980	-	980	None	-	-	980	New plant	Inactive
South Fork		32									
Cook, Nebr.		6	300	-	300	Secondary	Sat.	Sat.	(30)[f]	None	-
Talmage, Nebr.		25	400	-	400	Secondary	Sat.	Unsat.	120	None	-
Long Creek		13									
Auburn, Nebr.		1	2,800	280	3,080	None	-	-	3,080	New plant	Inactive
Rock Creek	539.1										
Rockport, Mo.		9	1,000	-	1,000	None	-	-	1,000	New plant	Inactive
Tarkio River	523.5										
East Tarkio Creek		21									
Stanton, Ia.		42	480	-	480	Secondary	Unsat.	Unsat.	380	Replace	Inactive
Tarkio, Mo.		21	1,680	-	1,680	None	-	-	1,680	New plant	Plans approved
Fairfax, Mo.		15.2	720	-	720	None	-	-	720	New plant	Inactive
Big Nemaha River	511.2										
South Fork		40.5									
Seneca, Kansas		52.1	1,970	-	1,970	Minor[e]	Unsat.	Unsat.	1,900	Replace	Inactive
Turkey Creek		46									
Pawnee City, Nebr.		19	1,600	-	1,600	Secondary	Sat.	Sat.	400	None	-
North Fork		40.8									
Adams, Nebr.		90	360	-	360	Secondary	Sat.	Sat.	90	None	-
Sterling, Nebr.		70.5	300	-	300	Primary	Sat.	Sat.	150	None	-
Tecumseh, Nebr.		56.6	1,600	680	2,280	None	-	-	2,280	New plant	Inactive
Humboldt, Nebr.		38.4	1,300	-	1,300	None	-	-	1,300	New plant	Inactive
Falls City, Nebr.		26.2	6,300	5,240	11,540	None	-	-	11,540	New plant	Inactive
Pony Creek		25.2									
Sabetha, Kans., North Plant		18	1,300	-	1,300	Secondary	Sat.	Sat.	180	None	-
Walnut Creek		25									
Morrill, Kans.		16	280	-	280	Secondary	Sat.	Unsat.	130	Addition	Inactive
Hiawatha, Kans., Pl. No.3		18	600	1,500	2,100	Secondary	Sat.	Sat.	250	None	-
Squaw Creek Ditch	500										
Davis Creek		13.5									
Mound City, Mo.		2.5	880	-	880	None	-	-	880	New plant	Inactive
Wolf Creek	496										
Hiawatha, Kans., Pl. No.1		34	1,400	-	1,400	Secondary	Sat.	Sat.	350	None	-
Hiawatha, Kans., Pl. No.2		34	800	-	800	Secondary	Sat.	Sat.	200	None	-
Robinson, Kans.		27	300	-	300	Primary	Unsat.	Unsat.	200	Enlarge	Inactive
Nodaway River	463.9										
West Nodaway River		120									
Villisca, Ia.		0.1	1,800	-	1,800	None	-	-	1,800	New plant	Plans initiated
Clarinda, Ia., State Hospital		-	2,080	20	2,100	None	-	-	2,100	New plant	Plans initiated
Clarinda, Ia.		102.3	4,200	800	5,000	None	-	-	5,000	New plant	Plans initiated
East Nodaway River		92									
Corning, Ia.		66	1,800	-	1,800	Secondary	Sat.	Unsat.	900	None	-
Burlington Junction, Mo.		71.6	500	-	500	None	-	-	500	New plant	Inactive
Skidmore, Mo.		49	280	-	280	Secondary	Sat.	Unsat.	80	None	-
Maitland, Mo.		41.5	430	-	430	None	-	-	430	New plant	Inactive
Dillon Creek	452										
Savannah, Mo.		14	2,000	-	2,000	Secondary	Sat.	Sat.	200	None	-
St. Joseph, Mo.	448		58,900	85,880	144,780	None	-	-	144,780	New plant	Under consideration
Peters Creek	433.8										
Troy, Kans.		9	800	-	800	Secondary	Sat.	Unsat.	300	None	-
Wathena, Kans.		1	400	360	760	Primary	Unsat.	Unsat.	600	Enlarge	Inactive
Atchison, Kans.	424.5		11,000	19,000	30,000	None	-	-	30,000	New plant	Inactive
Bear Creek	414.8										
Weston, Mo.		2	420	-	420	None	-	-	420	New plant	Inactive
Federal Penitentiary, Leavenworth, Kans.	410.5		2,590	-	2,590	None	-	-	2,590	New plant	(g)
Ft. Leavenworth, Kans.	410.5		6,000	-	6,000	None	-	-	6,000	New plant	(g)
Leavenworth Federal Penitentiary Farm, Mo.	410.0		120	-	120	None	-	-	120	New plant	Plans initiated
Leavenworth, Kans.	408.2		15,000	800	15,800	None	-	-	15,800	New plant	Plans initiated
Veterans Hospital Wadsworth, Kans.	407		5,000	-	5,000	None	-	-	5,000	New plant	(g)
Platte River	402.5										
Creston, Ia.		243.6	7,400	700	8,100	Secondary	Sat.	Sat.	1,000	None	-
102 River		79									
East Fork		62									
Lenox, Ia.		34	1,000	-	1,000	Minor[e]	Unsat.	Sat.	750	Replace	Plans approved
Bedford, Ia.		15	1,800	1,000	2,800	Secondary	Unsat.	Unsat.	1,000	Enlarge	Inactive
Maryville, Mo.		59	3,900	4,500	8,400	None	-	-	8,400	New plant	Two plants under construction

Table 18-2. Lower Missouri River Sub-Basin - Basic data on sources of municipal pollution (cont.)

Receiving stream, name and location of municipality^a	River miles above mouth: Missouri River	River miles above mouth: Tributary	Population served by sewers	Pop. equiv. (B.O.D.) industrial wastes to municipal sewers	Population equivalent (B.O.D.) untreated waste	Waste treatment provided	Adequacy of treatment facilities: Cap'y	Adequacy of treatment facilities: Oper.	Population equivalent discharged to watercourse	Project needs	Current status municipal action
Missouri River											
Platte River	402.5										
Little Platte River		26.5									
Horse Fork Creek		25									
Plattsburg, Mo. #1		0.5	400	-	400	Secondary	Unsat.	Unsat.	200	Replace	Inactive
West Branch Creek		20									
Plattsburg, Mo. #2		1	340	-	340	Secondary	Unsat.	Unsat.	170	Replace	Inactive
Smithville, Mo.		9	600	-	600	Primary^b	Unsat.	Unsat.	[illegible]	Addition	Inactive
Platte City, Mo.		15.5	860	-	860	Secondary^b	Sat.	Unsat.	440	None	-
Nine Mile Creek	399.5										
State Penitentiary, Lansing, Kansas		1	2,000	2,680	4,680	None	-	-	4,680	New plant	Under construction
Kansas City, Kansas	380.0		50,000	21,000	71,000	None	-	-	71,000	New plant	Plans initiated
Kansas River	378.3										
Kansas City, Mo.^j		5	(99,000)	(182,200)	(281,200)	(None)	-	-	(281,200)	(New plant)	(Inactive)
Kansas City, Kans.^j		5	(98,000)	(156,100)	(254,100)	(None)	-	-	(254,100)^j	(New plant)	(Plans initiated)
North Kansas City, Mo.	377.0		6,000	82,300	88,300	None	-	-	88,300	New plant	Inactive
Kansas City, Mo.	377.0		65,000	41,400	106,400	None	-	-	106,400	New plant	Inactive
Rock Creek	376.2										
Crestview Subdivision, Mo.		2	300	-	300	Secondary	Sat.	Unsat.	60	None	-
Big Blue River	365.7										
Indian Creek		26									
Lenexa, Kansas		15	480	-	480	Secondary	Sat.	Sat.	100	None	-
Glenwood Heights, Kans.		6	100	-	100	Secondary	Sat.	Sat.	20	None	-
Dykes Branch		1.7									
Leawood Development, Kans.		5	3,400	-	3,400	Secondary	Unsat.	Unsat.	2,000	Enlarge	Preliminary study
Tributary		1.5									
Friendly Homes Subdiv., Mo.		1	300	-	300	Secondary	Unsat.	Sat.	60	Enlarge	Inactive
Worall Gardens, Mo.		0.8	300	-	300	Secondary	Sat.	Sat.	60	None	-
Home Manor Subdiv., Mo.		0.5	350	-	350	Secondary	Sat.	Sat.	70	None	-
Round Grove Creek		11.5									
Tributary		2.5									
Sni-A-Bar Subdiv., Mo. (N.E.)		1	200	-	200	Secondary	Sat.	Sat.	40	None	-
Kansas City, Mo.		2	305,000	37,000	342,000	None	-	-	342,000	New plant	Inactive
Jackson Co. Sewer Dist. #1, Mo. (outfall #2)	363.5		6,800	-	6,800	None	-	-	6,800	New plant	Inactive
Sugar Creek	357.4										
Independence, Mo. (west side)		3	22,100	-	22,100	None	-	-	22,100	New plant	Inactive
Sugar Creek, Mo.		1.5	1,480	-	1,480	None	-	-	1,480	New plant	Inactive
Jackson Co. Sewer Dist. #1, Mo. (outfall #1)		1	6,800	-	6,800	None	-	-	6,800	New plant	Inactive
Rush Branch	350.5										
Liberty, Mo.		4	4,500	200	4,700	None	-	-	4,700	New plant	Inactive
Little Blue River	348.7										
Cedar Creek		30									
Tributary		5.5									
Lees Summit, Mo. (S.W. Plant)		1	560	-	560	Secondary	Unsat.	Unsat.	280	Replace	Plans approved
Tributary		3									
Lees Summit, Mo. (N.W. Plant)		1.5	340	-	340	Secondary	Unsat.	Unsat.	170	Replace	Plans approved
Little Cedar Creek		34									
Unity Farm, Mo.		3	180	-	180	Primary	Unsat.	Unsat.	90	Addition	Inactive
Hay Brook		27.5									
Jackson Co. Home, Mo.		3.5	600	-	600	Secondary	Sat.	Unsat.	90	None	-
East Fork		22.3									
Lees Summit, Mo. (N.E. Plant)		12	1,000	300	1,300	Secondary	Unsat.	Unsat.	600	Replace	Plans approved
Lees Summit, Mo. (S.E. Plant)		-	540	-	540	Secondary	Unsat.	Unsat.	300	Replace	Plans approved
Tributary		2.5									
Lake Tapawingo, Mo.		1.5	750	-	750	None	-	-	750	New plant	Inactive
Spring Branch Cr.		18.2									
Independence, Mo. (E. Plant)		7	6,800	-	6,800	Secondary	Unsat.	Unsat.	3,600	Replace	Under construction
Lake City Ordnance Works, Mo.		14.9	3,000	-	3,000	Secondary	Sat.	Sat.	600	None	-
Tributary		11.0									
McCune Home, Mo.		1	100	-	100	Secondary	Sat.	Sat.	20	None	-
Fishing River	337.2										
East Fork		13									
Excelsior Springs, Mo.		7.5	5,900	500	6,400	Secondary	Unsat.	Sat.	2,200	Enlarge	Report submitted
Sni-A-Bar Creek	326.1										
West Fork		10									
Lake Lotawana, Mo.		8.1	280	-	280	Secondary^b	Sat.	Unsat.	190	None	-
Lexington, Mo.	321		2,350		2,350	None	-	-	2,350	New plant	Inactive
Crooked River	316.1										
West Fork		12									
Richmond, Mo.		5	3,800	-	3,800	Minor^e	Unsat.	Unsat.	3,300	Replace	Inactive
Tabo Creek	310.5										
Tributary		6									
Higginsville, Mo. (S. Plant)		4	1,200	-	1,200	Secondary	Unsat.	Unsat.	600	Replace	Inactive
Waverly, Mo.	297.5		840	-	840	None	-	-	840	New plant	Inactive
Mose Creek	292										
Drainage Ditch		15.9									
Norborne, Mo.		1.3	1,080	-	1,080	Primary	Unsat.	Unsat.	800	Replace	Inactive
Wakenda Canal	287.5										
Carrollton, Mo.		14	3,660	2,700	6,360	None	-	-	6,360	New plant	Inactive
Bear Creek	255										
Slater, Mo.		10	2,100	-	2,100	Secondary	Sat.	Sat.	[illegible]	None	-
Glasgow, Mo.	226.5		880	-	880	None	-	-	880	New plant	Inactive
Lamine River	202.2										
Flat Creek		64									
Brushfoot Branch		10									
Sedalia, Mo. (S.E. Plant)		2.8	4,000	1,000	5,000	Secondary	Sat.	Sat.	500	None	-
Muddy Creek		39									
Brushy Creek		40									
Sedalia, Mo. (E. Plant)		3	4,000	-	4,000	Secondary	Sat.	Sat.	600	None	-
Sewer Branch		36									
Sedalia, Mo. (N.W. Plant)		4	4,000	4,800	8,800	Secondary	Sat.	Sat.	880	None	-
Blackwater River		9.5									
Branch		108									
Holden, Mo.		4	1,180	200	1,380	Primary	Unsat.	Unsat.	1,000	Replace	Inactive
Postoak Creek		90									
Warrensburg, Mo. (W. outfall)		4	3,400	-	3,400	None	-	-	3,400	New plant	Report submitted
Bear Creek		61									
Branch		3									
Warrensburg, Mo. (E. Plant)		2	1,100	-	1,100	Secondary^b	Unsat.	Unsat.	1,100	Replace	Report submitted

Table 18-2. Lower Missouri River Sub-Basin - Basic data on sources of municipal pollution (cont.)

Receiving stream, name and location of municipality*	River miles above mouth		Population served by sewers	Pop. equiv. (B.O.D.) industrial wastes to municipal sewers	Population equivalent (B.O.D.) untreated waste	Waste treatment provided	Adequacy of treatment facilities		Population equivalent discharged to watercourse	Project needs	Current status municipal action
	Missouri River	Tributary					Cap'y	Oper.			
Missouri River											
Lamine River	202.2										
Blackwater River		9.3									
Clear Creek		76									
Sedalia Air Base, Mo.		-	-	-	-	Secondary	-	-	-	-	-
Panther Creek		61									
Concordia, Mo. (south)		6	700	-	700	Secondary	Sat.	Unsat.	140	None	-
Davis Creek		81									
Odessa, Mo.		36	1,380	-	1,380	Secondary	Unsat.	Unsat.	800	Replace	Under construction
Branch		10									
Higginsville, Mo. (S. Plant)		3	1,600		1,600	Secondary	Unsat.	Unsat.	500	Replace	Inactive
Branch		11									
Concordia, Mo. (North)		2	300	1,900	2,200	Secondary	Sat.	Unsat.	1,100	None	-
Sweet Springs, Mo.		0.5	720	600	1,320	Secondary	Sat.	Sat.	100	None	-
Salt Fork Blackwater River		12									
Marshall, Mo. (N. Plant)		14	6,000	-	6,000	Secondary	Sat.	Sat.	600	None	-
Marshall, Mo. (S. Plant)		14	2,800	2,000	4,800	Secondary	Sat.	Sat.	480	None	-
[illegible] Creek		6									
Pilot Grove, Mo. (N. Plant)		6	260	-	260	Secondary	Sat.	Unsat.	30	None	-
Boonville, Mo.	196.2		6,000	-	6,000	None	-	-	6,000	New plant	Inactive
State Boys Home, Boonville, Mo.			470	-	470	None	-	-	470	New plant	Inactive
Bonne Femme Creek	191.6										
Branch		-									
Fayette, Mo. (N. Plant)		22	1,800	-	1,800	Secondary[k]	Unsat.	Unsat.	1,800	Replace	Inactive
Fayette, Mo. (S. Plant)		22	1,000	-	1,000	Secondary[k]	Unsat.	Unsat.	800	Replace	Inactive
New Franklin, Mo.		7	1,000	-	1,000	None	-	-	1,000	New plant	Inactive
Petite Saline Creek	177										
Branch		37									
Pilot Grove, Mo. (S. Plant)		1	260	-	260	Secondary	Sat.	Unsat.	90	None	-
Perche Creek	170										
Hinkson Creek		11									
Flat Branch		6									
Columbia, Mo.		1	31,400[l]	3,500	34,900	Secondary	Unsat.	Sat.	17,000	Enlarge	Report submitted
Moniteau Creek	157.5										
Tipton, Mo.		38	1,080	-	1,080	Secondary	Sat.	Sat.	100	None	-
Brush Creek		11									
California, Mo. (N.W. Plant)		9	850	250	1,100	Minor[a]	Unsat.	Unsat.	870	Replace	Plans initiated
California, Mo. (S.E. Plant)		9	300	-	300	Minor[a]	Unsat.	Unsat.	250	Replace	Plans initiated
Jefferson City, Mo.	143		24,600	1,000	25,600	None	-	-	25,600	New plant	Inactive
Moreau River	137.9										
North Moreau Creek		34									
Straight Fork		41									
Versailles, Mo.		16	1,380	-	1,380	Secondary	Sat.	Unsat.	270	None	-
Branch		32									
California, Mo. (S.W. Plant)		3	300	380	680	Secondary	Sat.	Unsat.	100	None	-
California, Mo. (S.E. Plant)		3	180	-	180	Minor[a]	Unsat.	Unsat.	180	Replace	Plans initiated
South Moreau Creek		36									
[illegible]'s Creek		21									
Eldon, Mo.		6	2,250	6,000	8,250	Secondary	Sat.	Sat.	3,000	None	-
State Reformatory, Algoa, Mo.	135.0		540	-	540	None	-	-	540	New plant	Inactive
Auxvasse Creek	119.7										
Brush Creek		34									
Auxvasse, Mo.		3	370	-	370	Minor[h]	Unsat.	Unsat.	370	Replace	Inactive
Stinson Creek		6									
Fulton, Mo. (Includes State Hospital No. 1)		11	8,040	-	8,040	Secondary	Unsat.	Sat.	3,000	Enlarge	Under construction
Chamois, Mo.	116.0		470	-	470	None	-	-	470	New plant	Inactive
Hermann, Mo.	98.9		2,300	1,000	3,300	None	-	-	3,300	New plant	Inactive
Loutre River	95.5										
Little Loutre Creek		36									
Coal Branch		9									
Wellsville, Mo.		2	1,280	-	1,280	Primary	Unsat.	Unsat.	640	Replace	Plans approved
Clear Fork		29									
Montgomery City, Mo.		6	850	-	850	Primary	Sat.	Unsat.	580	Addition	Plans approved
New Haven, Mo.	80.7		680	-	680	None	-	-	680	New plant	Inactive
Washington, Mo.	68.8		5,970	1,000	6,970	None	-	-	6,970	New plant	Inactive
St. Charles, Mo.	28.1		13,730	1,240	14,970	None	-	-	14,970	New plant	Inactive
Coldwater Creek	7.0										
St. Ann's Village, Mo.		18.5	4,560	-	4,560	Secondary	Unsat.	Sat.	3,200	Enlarge	Inactive
St. Ann's Hills, Mo.		-	3,200	-	3,200	Secondary	Sat.	Sat.	190	None	-
St. John's, Mo. (Overland Sewer Dist.)		18	20,000	-	20,000	Secondary	Unsat.	Sat.	4,800	Enlarge	Plans approved
Bridgeton Terrace Subdivision, Mo.		17.5	580	-	580	Secondary	Sat.	Unsat.	60	None	-
Bridgeport, Mo.		17	60	-	60	Minor[a]	Unsat.	Unsat.	60	Addition	Inactive
Naval Air Station #04, Mo.		16	-	-	-	Secondary	Sat.	Sat.	-	None	-
Naval Air Station #40, Mo.		16	-	-	-	Secondary	Sat.	Sat.	-	None	-
Branch		15.8									
McDonnell Aircraft Co., Mo.			6,000	-	6,000	Secondary	Sat.	Sat.	600	None	-
Ford Motor Co., Mo. (Lincoln-Mercury Div.)			2,200	-	2,200	Secondary	Sat.	Sat.	220	None	-
Edmundson Terrace Subdiv., Mo.		2	600	-	600	Secondary	Sat.	Unsat.	60	None	-
Berkeley Plant #1		1	1,800	-	1,800	Primary	Sat.	Sat.	1,200	None	-
Florissant, Mo.		12	3,700	-	3,700	Primary	Unsat.	Unsat.	2,800	Addition	Inactive
St. Ferdinand, Mo.		-	300	-	300	Primary	Sat.	Sat.	200	None	-
East Branch		11									
Belvaire Place Subdivision, Mo.		3	120	-	120	Secondary	Sat.	Unsat.	10	None	-
Wickham Park Subdivision, Mo.		2	100	-	100	Secondary	Sat.	Unsat.	10	None	-
Totals			1,800,430	1,498,980	2,899,410				2,615,170		

268 - Number of municipalities
285 - Sources of pollution

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a. Septic tank.
b. Landlocked.
c. Approximately 20 percent of municipal sewage discharged to Floyd River.
d. Iowa Great Lakes Sewage System serves 4,000 persons throughout the year and 30,000 during summer resort months.
e. 60,000 addition to sewage plant - Little Papillion Creek.
f. Discharge to ground.
g. Plans under way to discharge to proposed sewage plant at Leavenworth, Kansas.
h. Plant not in operation.
i. That portion discharged to the Kansas River not included in totals. Kansas River portion includes 1,000 population equivalents discharging to Turkey Creek Sewer and industries discharging to municipal sewers, (see Kansas River Sub-Basin).
j. That portion discharged to Kansas River which includes 7,200 population equivalents discharged direct by stockyards not included in totals.
k. Filters not in operation.
l. Includes 9,000 students of Missouri University, Stephen's College, and Christian College.

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

Table III-3. Lower Missouri River Sub-Basin - Basic data on sources of industrial pollution - Industries discharging wastes directly to watercourses.

Receiving stream, name, and location of industry[1]	River miles above mouth: Missouri River	River miles above mouth: Tributary	Type of industry	Type of waste produced	Population equivalent untreated	Treatment or other pollution control measures: Degree	Adequacy: Cap'y	Adequacy: Oper.	Population equivalent (B.O.D.) discharged to watercourse	Project needs or equivalent control measures	Current status industrial action
Missouri River											
The New England Distilling Co., Yankton, S. D.	820.0		Food products	Organic	6,800	None	-	-	6,800	New plant	Inactive
Vermillion Creek	806.1										
East Fork		70									
De Smet Rendering Works, De Smet, S. D.		(b)	Food products	Organic	1,500	Primary	Sat.	Sat.	1,000	None	-
Tri-State Produce Co., Sioux City, Ia.	759		Food products	Organic	3,500	None	-	-	3,500	New plant	Inactive
T & W Packing Co., Sioux City, Ia.	759		Food products	Organic	1,800	None	-	-	1,800	New plant	Inactive
Meyer Packing Co., Sioux City, Ia.	759		Food products	Organic	2,400	None	-	-	2,400	New plant	Inactive
Sanitary Rendering Co., Sioux City, Ia.	759		Food products	Organic	600	None	-	-	600	New plant	Inactive
Allied Laboratories, Inc., Sioux City, Ia.	759		Drug products	Organic	6,000	None	-	-	6,000	New plant	Inactive
Floyd River	758.3										
Nameless Creek		72									
Creamery, Sanborn, Ia.		14	Food products	Organic	3,700	None	-	-	3,700	New plant	Under orders
Rendering Plant, Alton, Ia.		68	Food products	Organic	-	None	-	-	-	New plant	Inactive
Rendering Plant, Le Mars, Ia.		31.9	Food products	Organic	-	None	-	-	-	New plant	Inactive
West Branch		23									
Creamery, Boyden, Ia.		33	Food products	Organic	1,000	None	-	-	1,000	New plant	Inactive
Creamery, Hull, Ia.		-	Food products	Organic	800	Lagoon	Unsat.	Unsat.	800	Replace	Inactive
Nameless Creek		15.5									
Creamery, Orange City, Ia.		11	Food products	Organic	500	None	-	-	500	New plant	Inactive
Albertson & Co., Sioux City, Ia.		4	Automotive tools	Organic and inorganic	-	None	-	-	-	New plant	Inactive
Farmers Produce Co., Sioux City, Ia.		0.5	Food products	Organic	2,200	None	-	-	2,200	New plant	Inactive
Armour Co. } Cudahy Co. } Swift Co. } Sioux City, Ia.		0.5	Food products	Organic	700,000	None None None None	-	-	700,000	New plant New plant New plant New plant	Inactive Inactive Inactive Inactive
Smith Packing Co., Sioux City, Ia.		0.5	Food products	Organic	2,400	None	-	-	2,400	New plant	Inactive
American Serum Co., Sioux City, Ia.		0.5	Drug products	Organic	800	None	-	-	800	New plant	Inactive
Swift D & P, Sioux City, Ia.		0.5	Food products	Organic	5,000	None	-	-	5,000	New plant	Inactive
Little Sioux River	685.5										
Rendering Plant, Linn Grove, Ia.		182	Food products	Organic	400	Primary	Sat.	Sat.	150	None	-
Rendering Plant, Quimby, Ia.		138	Food products	Organic	-	None	-	-	-	New plant	Inactive
Maple River		15									
Rendering Plant, Galva, Ia.		66	Food products	Organic	-	None	-	-	-	New plant	Inactive
Greater Omaha Packing Co., Omaha, Nebr.	631.4		Food products	Organic	2,600	None	-	-	2,600	New plant	Inactive
South Omaha Packers, Omaha, Nebr.	631.4		Food products	Organic	21,000	None	-	-	21,000	New plant	Inactive
Quaker Oats Furfural Plant, Omaha, Nebr.	631.4		Chemical products	Organic	280,000	None	-	-	280,000	New plant	Inactive
Mosquito Creek	622.3										
Rendering Plant, Council Bluffs, Ia.		26	Food products	Organic	-	None	-	-	-	New plant	Inactive
Keg Creek	604.5										
Packing Plant, Glenwood, Ia.		11	Food products	Organic	10,000	None	-	-	10,000	New plant	Inactive
Nishnabotna River	560.8										
West Nishnabotna River		12									
Rendering Plant, Oakland, Ia.		70-	Food products	Organic	-	None	-	-	-	New plant	Inactive
East Nishnabotna River		12									
Creamery, Audubon, Ia.		10	Food products	Organic	10,000	Land application	Sat.	Sat.	(c)	None	-
Rendering Plant, Atlantic, Ia.		99.4	Food products	Organic	-	None	-	-	-	New plant	Inactive
Big Nemaha River	511.2										
Walnut Creek		25									
Hiawatha Rendering Co., Hiawatha, Kans.		15	Food products	Organic	900	Minor[a]	Sat.	Sat.	(c)	None	-
Nodaway River	480.9										
East Nodaway River		92									
Rendering Plant, Corning, Ia.		44	Food products	Organic	-	Primary	Unsat.	Unsat.	700	Replace	Inactive
Consumer's Co-Op, St. Joseph, Mo.	460		Chemical products	Organic and inorganic	-	None	-	-	-	New plant	Inactive
Armour & Co., St. Joseph, Mo.	460		Food products	Organic	289,200	None	-	-	289,200	New plant	Inactive
Swift & Co., St. Joseph, Mo.	460		Food products	Organic	168,000	None	-	-	168,000	New plant	Inactive
Makin Produce Co., St. Joseph, Mo.	460		Food products	Organic	3,320	None	-	-	3,320	New plant	Inactive
Amber Serum Co., St. Joseph, Mo.	460		Drug products	Organic	16,600	None	-	-	16,600	New plant	Inactive
Bear Creek	414.6										
McCormick Distillery, Weston, Mo.		2	Food products	Organic	1,080	None	-	-	1,080	New plant	Inactive
National Battery Co., Leavenworth, Kans.	406.2		Electrical products	Inorganic	-	None	-	-	-	New plant or connect to municipal sewers	Inactive
Platte River	402.5										
Ravenwood Co-Op Creamery, Ravenwood, Mo.		189	Food products	Organic	800	None	-	-	800	New plant	Inactive

Table 13-3. Lower Missouri River Sub-Basin - Basic data on sources of industrial pollution - Industries discharging wastes directly to watercourses (cont.)

Receiving stream, name, and location of industry¹	River miles above mouth: Missouri River	River miles above mouth: Tributary	Type of industry	Type of waste produced	Population equivalent untreated	Treatment or other pollution control measures: Degree	Adequacy: Eng'g	Adequacy: Oper.	Population equivalent (B.O.D.) discharged to watercourse	Project needs or equivalent control measures	Current status industrial action
Missouri River											
Phillips Oil Refinery Kansas City, Kans.	380.2		Petroleum products	Organic and inorganic	36,000	Primary	Sat.	Sat.	24,000	None	-
Corn Products Refining Co. North Kansas City, Mo.	378.8		Food products	Organic	58,000[f]	-	-	-	58,000[f]	Addition	Plans initiated
Schenley Distilleries, Inc. Kansas City, Mo.	378.6		Food products	Organic	70,000	None	-	-	70,000	New plant or connect to municipal sewers	Inactive
Blue River	358.7										
Jackson Creek		28									
Westinghouse & Bendix Jackson County, Mo.		0.6	Aircraft	-	-	Settling ponds	Unsat.	Unsat.	-	Enlarge	Inactive
Round Grove Creek		11.6									
Belts Packing Co. Raytown, Mo.		4	Food products	Organic	1,600	Secondary	Sat.	Sat.	800	None	-
Chevrolet Assembly Plant Kansas City, Mo.		10.6	Transportation equipment	Organic and inorganic	10,000	None	-	-	10,000	New plant	Inactive
Fisher Body Co. Kansas City, Mo.		10.6	Transportation equipment	Organic and inorganic	2,700	None	-	-	2,700	New plant	Inactive
Koppers Corp. Wood Preserving Div. Kansas City, Mo.		9.8	Wood products	Organic	1,680	None	-	-	1,680	New plant	Inactive
American Creosote Co. Kansas City, Mo.		8	Wood products	Organic	800	None	-	-	800	New plant	Inactive
Union Wire Rope Corp. Kansas City, Mo.		7.8	Metal products	Inorganic	-	None	-	-	-	New plant	Inactive
Black, Sivalls & Bryson Kansas City, Mo.		6	Metal products	Organic and inorganic	680	None	-	-	680	New plant	Inactive
American Asphalt Roofing Co. Kansas City, Mo.		6.0	Petroleum products	Organic	8,000	None	-	-	8,000	New plant	Inactive
Vendo Co. Kansas City, Mo.		5.5	Machinery	Organic and inorganic	1,880	None	-	-	1,880	New plant	Inactive
Ford Motor Assembly Plant Kansas City, Mo.		5	Transportation equipment	Organic and inorganic	4,560	None	-	-	4,880	New plant	Inactive
Sheffield Steel Corp. Kansas City, Mo.		3	Primary metals	Organic and inorganic	80,000	None	-	-	80,000	New plant	Inactive
Sugar Creek	357.4										
Standard Oil Refinery Sugar Creek, Mo.		1	Petroleum products	Organic	22,800	Primary	Sat.	Sat.	11,400	None	-
Little Blue River	340.7										
Cedar Creek		39									
Tributary		3.5									
Rice's Sausage Co. Lees Summit, Mo.		1	Food products	Organic	1,440	None	-	-	1,440	New plant	Inactive
Oldham Farm Sausage Lees Summit, Mo.		1	Food products	Organic	310	Minor[a]	Unsat.	Unsat.	-(d)	Replace	Inactive
Lake City Ordnance Works Lake City, Mo.		14	Ordnance and accessories	Organic and inorganic	-	Secondary	Sat.	Sat.	-	None	-
Sni-A-Bar Creek	326.1										
Blue Branch		14.5									
Adams Dairy Blue Springs, Mo.		5	Food products	Organic	600	Secondary	Unsat.	Unsat.	400	Enlarge	Inactive
Tabo Creek	310.0										
Tributary		8									
Buck's Slaughterhouse Higginsville, Mo.		5	Food products	Organic	1,200	None	-	-	1,200	New plant	Inactive
Lamine River	202.2										
Flat Creek		44									
Breakfast Branch		10									
Ideal Packing Co. Sedalia, Mo.		3	Food products	Organic	720	Minor[a]	Unsat.	Unsat.	600	Replace	Inactive
Muddy Creek		29									
Sewer Branch		24									
Kohl Packing Co. Sedalia, Mo.		3	Food products	Organic	360	Minor[a]	Unsat.	Unsat.	300	Replace	Inactive
Blackwater Creek		9.5									
Davis Creek		31									
Branch		19									
Lechleffner Custom Slaughtering, Higginsville, Mo.		3	Food products	Organic	300	None	-	-	300	New plant	Inactive
Nona Creamery Nona, Mo.		7	Food products	Organic	4,000	Minor[a]	Unsat.	Unsat.	4,000	Replace	Inactive
Salt Fork Blackwater River		12									
Alma Creamery Alma, Mo.		40	Food products	Organic	580	None	-	-	580	New plant	Inactive
Moniteau Creek	187.5										
Brush Creek		11									
Moniteau Mills California, Mo.		9	Clothing	Organic	1,680	Settling pond	Unsat.	Unsat.	1,680	Replace	Inactive
Cedar Creek	159										
Acid Mine Waste, Boone and Calloway Counties, Mo.			Coal	Inorganic	-	None	-	-	-	New plant	Inactive
Loose Creek	128										
Ashley Milk Co. Linn, Mo.		16	Food products	Organic	580	Secondary	Sat.	Sat.	340	None	-
Coldwater Creek	7.0										
McDonnell Aircraft Co. St. Louis County, Mo.		15	Aircraft	Inorganic	-	None	-	-	-	New plant	-
Mercury-Lincoln Ford Motor Assembly Plant, St. Louis County, Mo.		14	Automobiles	Inorganic	-	None	-	-	-	New plant	-
Total of 73 industries					1,720,080				1,088,880		

a. Septic tank.
b. Landlocked
c. Tile field - pollution does not reach watercourse.
d. Subsurface irrigation
e. Preliminary treatment - then to city sewers.
f. Twenty-five percent future expansion planned; internal "bottle-up" waste recovery process reduces waste produced; additional treatment methods under consideration.

¹Industries having separate outlets.

LOWER PLATTE RIVER SUB-BASIN

This section is derived essentially from the report "Lower Platte River Basin Water Pollution Investigation" published June 1950. Factual data of this cooperative State-Federal report were brought up-to-date as of January 1, 1953, by the State Water Pollution Control Agency of Nebraska.

General Description

The Platte River, formed by the junction of the North and South Platte Rivers east of the City of North Platte, Nebraska, flows 310 miles eastward to join the Missouri River at Plattsmouth, Nebraska. The drainage basin is about 420 miles long; all of the area of 28,800 square miles lies within the State of Nebraska.

The Platte flows in a broad, sandy, shallow bed over most of its course. Throughout its length very little water is received from southside tributaries, almost all of the flow being contributed by the Loup and Elkhorn Rivers entering from the north. Most of the relatively constant discharge of the latter two rivers has its origin in the Sand Hills of western Nebraska and is supplemented by runoff from the loess soils section in the eastern third of the State.

Wide ranges in climatic conditions prevail throughout the Sub-Basin. These vary from humid to subhumid near the Missouri River, and from semiarid in the central part of the State to arid in the western portion. Precipitation at the Missouri River amounts to about 28 inches, decreasing gradually to about 18 inches in the western part of the State.

Heavy June rainfall causes high flow conditions and often results in flooding along some tributaries. Cessation of excessive rainfall together with diversion of water for irrigation and a period of high evaporation and transpiration results in greatly reduced and minimal stream flows. Likewise, diversion and storage for irrigation and hydroelectric power purposes on the North and South Platte Rivers in Wyoming, Nebraska, and Colorado affect discharges in the Platte River.

Agriculture and related activities form the basis of the economy. Vast grazing fields with an ample supply of water, coupled with accessibility of ready markets, combine to make livestock production highly significant. Wheat and corn have high dollar values while sugar beets, potatoes, alfalfa and other forage crops are lesser in importance. Related industries such as food processing plants, flour mills, creameries, egg packing, sugar beet refining, poultry dressing, and alfalfa dehydration plants are situated throughout the Basin.

Growth of population was steady until the decade 1920-1930, when minor reductions in rural areas took place because of a general economic depression concurrent with a period of abnormally low precipitation which made farming a risk. Migration was largely to areas where agricultural pursuits had been stabilized through use of irrigation. It is estimated that over 521,000 people reside in the Basin, with 66 percent living in rural areas.

Water Uses

Throughout the Lower Platte River Basin, 146 municipalities servicing 251,900 people with 38,780,000 gallons of water a day utilize the generally adequate ground sources. The City of Ord, the only community with a surface water supply, provides 2,600 people with an average of 300,000 gallons daily secured from the North Loup River.

The use of streams for sanitary purposes is increasing in importance. As most of the communities in the Basin utilize natural watercourses for removal and ultimate disposal of sewage, it is entirely proper to acknowledge the tremendous economic value due to such functions of this resource.

Industrial uses of water include processing, cooling, washing, and air conditioning. The growth of industry within the Basin has created an increased demand for adequate water supplies and this trend may be expected to continue with the anticipated expansion of industrial activity associated with the development of additional irrigation.

Early settlers who immigrated to the western regions of the Lower Platte River Basin soon discovered the speculation involved in dry-land farming. Irrigation dates back to 1866, and soon thereafter was recognized as an essential factor in the development of agriculture. Canals were constructed in the 1890's between Kearney on the Platte River and Keystone on the North Platte River. Irrigation works consisting of diversion and distribution projects were so constructed as to use the normal flow of the river. The tempo of construction was increased, particularly in the period 1891-1895, because of the attempt to organize and introduce legislation dealing with water rights and because of the severe drought which occurred in 1894-1895. Prior to the construction of Pathfinder (1908) and Guernsey (1927) Reservoirs in Wyoming, the nonseasonal flow was lost to downstream consumers.

The drought periods of the early thirties caused a great demand for adequate water storage by irrigators along the Platte River. A construction organization began work upon the Sutherland system in August 1934, the facilities of which were ready for operation in December 1935 and included a storage reservoir and distribution canals. This system has since received some of Lake McConaughy discharge, the latter being completed in 1938, to serve about 70,000 acres of land. Present irrigation serves about 25 percent of the potential arable area. Most of the land served by gravity irrigation lies in the Platte valley; the remainder is located in the North and Middle Loup valleys.

Well irrigation has been utilized throughout the Platte River valley, particularly between Central City and Gothenburg. Both gravity and well servicing methods, dependent upon the available water, are resorted to in farming areas west of Kearney. East of Kearney ground water elevations have declined despite recharge from the Platte River. Observers have noted that the rate of recharge has not met crop requirements, thereby resulting in an appreciable loss in the underground reservoir. Present ground water supplies required for developments in the North and Middle Loup as well as the Elkhorn irrigation systems, are also recognized as insufficient.

There are 11 hydroelectric power plants in the Basin with an installed capacity of 106,800 kilowatts. Prospects for developing additional hydroelectric power in the Lower Platte River Basin are good. However, sediment in quantity carried by the streams, being readily deposited because of low velocities resulting from the slight gradients of the rivers, adversely affects the storage capacity of hydroelectric power reservoirs. Also, maximum production of hydroelectric power would curtail potential irrigation developments which possess high priority; though conversely, the irrigation programs depend upon hydroelectric power for operation of district pumps as an integral feature of the planned irrigation system. Under the Basin development plan, with 10 proposed plants under consideration and with 9 of the existing hydroelectric plants remaining in operation, the present output would be exceeded.

Existing recreational facilities within the Basin are limited to 3 State parks; 16 areas designed as "State Recreational Grounds"; and 2 privately-owned and operated beach parks in eastern Nebraska. Several have overnight and weekend accommodations. Although the areas are small and inadequate, they provide good fishing. The need for recreation is reflected in the future planning of the area. The State of Nebraska is taking steps to protect public interests against encroachment by private entrepreneurs and has acquired frontage on the Johnson Regulating, Lake McConaughy, Maloney Regulating and Jeffrey Regulating Reservoirs.

The comprehensive plan of development for the maximum utilization of land and water resources in the Sub-Basin, as formulated by the Bureau of Reclamation, contemplates extension of irrigation, further development of hydroelectric power, improved recreation, fish and wildlife conservation, and consideration of public health and sanitation benefits. Sixteen reservoirs and 19 major diversion dams are included in the program.

A study was made of the probable frequency of low flows over the period of record. Table LP-1 presents the probable low mean monthly flow to be expected once in 2, 3, 5, and 10 years and the low mean month of record. Low flow frequencies serve to indicate the degree and probable recurrence of possible nuisances below sources of pollution, and provide a firm basis for sewage and waste treatment requirements.

Sources of Pollution

Surface water resources receive pollution from numerous municipal and industrial sources. Data on sources of pollution are presented in tables LP-2 and LP-3 and summarized in tables 1 and 2, Part I. There are 88 sources of municipal pollution, which includes industries connected to municipal sewerage, and 24 industries which discharge direct to streams. The population served is estimated at 242,610 while the population equivalent of waste produced by municipalities is 362,320; 49 communities provide treatment for 65 percent of the sewered population for a pollution reduction of 35 percent.

Five industries have treatment plants of which 4 are adequate. Industrial wastes discharged to streams have a population equivalent of 83,190. Industries in the Basin generally discharge their wastes to

Table LP-1. Lower Platte River Sub-Basin - Probable frequency of low mean monthly discharges

Years of Record	Stream and Location¹	Miles to mouth Platte River	Miles to mouth Tributary	Drainage Area Square Miles	Minimum monthly mean flows in cubic feet per second that may be expected once in: 2 years	3 years	5 years	10 years	Minimum²
	SUMMER (JUNE-SEPT)								
	Platte River								
11	Ashland	28.5			1,500	1,200	900	780	660
14	Duncan	115.0		4,652	1	0	0	0	0
14*	Grand Island	173.2			0	0	0	0	0
16*	Kearney	215.4			7	0	0	0	0
16*	Odessa	226.8			0	0	0	0	0
16	Near Overton	240.4		1,699	30	0	0	0	0
13	Lexington	252.5		1,625	1,000	270	200	140	30
6	Cozad	265.1			73	60	38	8	8
16*	Brady	291.5			140	100	50	17	0
16	Confluence North and South Platte near North Platte	309.8			370	180	120	78	39
	Elkhorn River	33.4							
15	Waterloo		12.4	6,564	290	220	190	130	87
8	Arlington		27.7		500	330	270	200	200
15*	Scribner		55.3		230	130	84	59	17
15*	Neligh		187.7	2,200	68	46	38	29	28
15*	Ewing		211.8		42	28	20	17	17
15*	O'Neill		236.1	654	18	14	10	8	8
	Logan Creek		43.8						
15*	Uehling		10.0	1,030	48	30	27	17	12
	North Fk. Elkhorn River		141.8						
15*	Norfolk		4.7		30	28	24	18	2
	Clearwater Creek		191.5						
15*	Clearwater		3.6		15	12	10	8	8
	South Fork Elkhorn River		210.1						
15*	Ewing		1.8		18	16	13	12	12
	Loup River	103.0							
15*	Columbus		0.2	14,200	750	220	180	102	76
15*	Genoa		26.9		640	77	54	0	0
	Beaver Creek		25.1						
15*	Genoa		2.6		64	51	46	40	37
15*	Boone		31.4		44	39	37	30	30
15*	Loretto Damsite		50.6		28	27	25	25	22
	Cedar River		60.0						
15*	Fullerton		6.2		130	120	120	97	84
15*	Ericson Damsite		62.3		91	86	80	77	74
15*	Ericson		69.9		62	57	55	52	50
	North Loup River		67.5						
14H	Near St. Paul)		3.5	4,040	480	410	390	360	230
14N	Near St. Paul)		3.5	4,040	530	510	450	460	440
14*	Near Ord		50.3		610	600	590	530	470
14*	Burwell		75.6		590	580	560	540	530
14*	Taylor		87.6		450	420	390	380	380
14*	Brewster Damsite		117.0		260	220	220	200	190
	Davis Creek		21.0						
14*	Near Cotesfield		1.5		3	3	2	2	2
	Middle Loup River		67.5						
14	St. Paul		3.5	7,300	620	600	560	450	390
18*	Arcadia		72.0		690	650	640	620	590
19*	Milburn Damsite		111.8		710	700	690	680	640
19*	Mullen Damsite		188.6		150	150	150	150	150
	South Loup River		35.2						
15*	St. Michael		7.8		130	120	110	110	96
15*	Ravenna		16.0		110	100	98	86	74
15*	Near Cumro		64.5		67	64	61	60	57
15*	Callaway		100.8		39	38	33	30	30
	Mud Creek		19.6						
15*	Near Ravenna		26.4		18	18	18	15	12
	Dismal River		129.7						
15H*	Dismal River Div. Dam		14.7		270	270	270	270	260
15N*	Dismal River Div. Dam		14.7		240	240	220	210	210
	Wood River	161.4							
15*	Amherst		84.0		5	3	2	2	2
	Buffalo Creek	231.4							
16*	Near Bison Reservoir Site		38.6		0	0	0	0	0
	Plum Creek	245.6							
16*	Near Plum Creek Reservoir Site		4.2		0	0	0	0	0
	North Platte River	309.8							
16	North Platte		5.0		260	137	100	39	44
16	Sutherland		26.4		89	32	13	5	2
16*	Keystone		52.5		240	200	110	47	5
16*	Martin		59.5		440	360	280	180	7
5	Lewellen		84.8		660	440	380	380	380
18	Oshkosh		94.2		390	380	270	180	17
	South Platte River	309.8							
16	North Platte		4.3		55	0	0	0	0

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[1] All streams and municipalities located within State of Nebraska.

[2] Low mean month.

*From records and estimates correlated with other flow data.

H - Historical flow.

N - Natural flow.

Table LP-1. Lower Platte River Sub-Basin - Probable frequency of low mean monthly discharge (cont'd)

Years of Record	Stream and Location[1]	Miles to mouth		Drainage Area Square Miles	Minimum monthly mean flows in cubic feet per second that may be expected once in:				
		Platte River	Tributary		2 years	3 years	5 years	10 years	Minimum[2]
	WINTER (DEC-FEB)								
	Platte River								
11	Ashland	28.5			2,400	2,000	2,000	1,600	1,300
14	Duncan	115.0		4,654	730	48	4	2	0
14*	Grand Island	173.2			920	310	61	3	0
16*	Kearney	215.6			1,300	1,100	600	200	72
16*	Odessa	224.8			1,200	980	400	84	44
16	Near Overton	240.4		1,699	1,300	1,100	640	300	160
19	Lexington	252.5			1,800	1,700	1,600	1,400	1,400
6	Cozad	265.1			730	180	140	130	130
16*	Brady	291.5			1,000	290	170	96	84
16	Confluence North and South Platte near North Platte	309.8			1,100	770	570	450	360
	Elkhorn River	33.4							
15	Waterloo		12.4	6,564	330	280	240	230	210
8	Arlington		27.7		450	350	250	160	140
15*	Scribner		55.3		220	180	100	96	34
15*	Neligh		107.7	2,200	120	100	69	59	30
15*	Ewing		211.8		64	62	44	27	[illegible]
15*	O'Neill		236.1	651	34	33	23	18	6
	Logan Creek		43.8						
15*	Uehling		30.0	1,030	47	44	36	28	27
	North Fk. Elkhorn River		141.8						
15*	Norfolk		0.7		28	24	16	14	12
	Clearwater Creek		193.5						
15*	Clearwater		3.6		22	22	17	15	8
	South Fork Elkhorn River		210.1						
15*	Ewing		1.0		27	26	22	[illegible]	12
	Loup River	103.0							
15*	Columbus		0.2	14,200	1,100	710	540	500	150
15*	Genoa		26.9		900	570	450	310	0
	Beaver Creek		25.1						
15*	Genoa		2.6		74	72	72	70	60
15*	Boone		31.4		58	58	54	50	45
15*	Loretto Damsite		50.6		42	42	38	30	27
	Cedar River		60.0						
15*	Fullerton		6.2		170	170	160	150	130
15*	Ericson Damsite		62.3		110	110	100	99	91
15*	Ericson		69.9		74	74	71	67	62
	North Loup River		67.5						
14^{H}	Near St. Paul		3.5	4,040	560	540	530	510	500
14^{N}	Near St. Paul		3.5	4,040	620	600	560	540	530
14*	Near Ord		50.3		670	580	530	500	430
14*	Burwell		75.6		650	620	580	570	360
14*	Taylor		87.6		350	350	320	310	290
14*	Brewster Damsite		117.0		300	280	260	280	250
	Davis Creek		21.0						
14*	Near Cotesfield		1.5		2	2	2	2	2
	Middle Loup River		67.5						
14	St. Paul		3.5	7,380	780	730	680	570	500
18*	Arcadia		72.0		700	680	590	440	370
19*	Milburn Damsite		111.8		720	700	660	670	570
19*	Mullen Damsite		188.6		160	150	150	150	130
	South Loup River		25.2						
15*	St. Michael		7.8		160	160	160	160	150
15*	Ravenna		16.0		140	140	140	140	130
15*	Near Cumro		61.5		92	90	91	87	86
15*	Callaway		100.6		55	54	54	54	50
	Mud Creek		19.4						
15*	Near Ravenna		24.4		18	18	18	15	8
	Dismal River		139.7						
15^{H}	Dismal River		14.7		270	270	270	260	260
15^{N}	Diversion Dam		14.7		260	250	220	210	180
	Wood River	161.4							
15	Amherst, Nebr.		84.0		5	3	2	2	2
	Buffalo Creek	231.4							
16*	Near Plum Reservoir Site		32.6		0	0	0	0	0
	Plum Creek	245.6							
16*	Near Plum Creek Reservoir Site		4.2		0	0	0	0	0
	North Platte River	309.8							
16	North Platte		5.0		740	560	380	310	310
16	Sutherland		26.4		450	140	110	100	84
16*	Keystone		52.5		350	29	8	4	3
16*	Martin		59.5		1,400	1,300	1,200	1,100	960
5	Lewellen		84.8		1,460	1,200	1,100	960	960
16	Oshkosh		96.2		1,300	1,200	1,100	930	910
	South Platte River	309.8							
16	North Platte		4.3		180	110	74	49	0

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[1] All streams and municipalities located within State of Nebraska.

[2] Low mean month.

*From records and estimates correlated with other flow data

H - Historical flow.

N - Natural flow

municipal sewerage systems. Industrial plants are usually small to moderate in size and most wastes are organic in nature and amenable to usual sewage treatment practices. Principal industries include dairies, packing houses, rendering plants, slaughterhouses, poultry dressing establishments, and a beet sugar refinery.

Municipal needs have been established for 40 new plants, 9 replacements, and 7 additions or enlargements. Industrial needs show 19 new plants and 1 addition. The cost of the recommended municipal and industrial waste treatment program is estimated at $8,300,000. This is a conservative estimate and does not include the cost of trunk sewers, operation, or maintenance.

Numerous sewage treatment plants have been constructed in the past several years. An acceleration of abatement progress is indicated, as is need for adequate State law for the control of pollution affecting water uses. Recent efforts to secure effective water pollution control legislation have failed.

Table LP-2. Lower Platte River Sub-Basin - Basic data on sources of municipal pollution

Receiving stream, name and location of municipality[1]	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) untreated waste	Waste treatment provided	Adequacy of treatment facilities Capy.	Oper.	Population equivalent discharged to watercourse	Project needs	Current status of municipal action
Platte River									
Hemingford	landlocked	800	800	Secondary	Sat.	Sat.	400[a]	None	-
Alliance	landlocked	7,500	9,500	Lagoon	Sat.	Sat.	(e)	None	-
Gothenburg	272.0	2,800	2,800	None	-	-	2,800	New plant	Plans approved
Cozad	265.1	3,600	3,680	None	-	-	3,680	New plant	Plans approved
Lexington	252.5	3,000	3,500	Minor[2]	Unsat.	Unsat.	3,500	Replace	Plans approved
Plum Creek	245.0								
Eustis	25.0	(b)	-	Secondary	Sat.	Sat.	-	None	-
Elm Creek	231.4								
Elm Creek	2.2	400	400	Primary	Sat.	Sat.	300	None	-
Axtell	landlocked	600	600	Secondary	Sat.	Sat.	150[a]	None	-
Turkey Creek	210.1								
State Boys Home, Kearney	7.5	200	200	Secondary	Sat.	Sat.	50	None	-
Kearney	1.5	10,480	12,840	None	-	-	12,840	New plant	Inactive
Wood River	161.4								
Gibbon	54.4	500	500	Minor[2]	Unsat.	Unsat.	500	Replace	Inactive
Shelton	41.3	700	700	Secondary	Sat.	Sat.	180	None	-
Wood River	32.6	600	600	Secondary	Sat.	Unsat.	150[a]	None	-
Grand Island	13.0	24,000	32,460[c]	Secondary	Sat.	Sat.	8,830[c]	None	-
Central City	148.4	1,890	3,130	Secondary	Sat.	Sat.	700	None	-
Silver Creek	127.2	300	300	None	-	-	300	New plant	Inactive
Loup River	103.0								
Middle Loup River	67.5								
Mullen	landlocked	480	480	Secondary	Sat.	Unsat.	240[a]	None	-
Thedford	135.5	150	150	None	-	-	150	New plant	Inactive
Sargent	86.3	500	500	Secondary	Sat.	Unsat.	120	None	-
Loup City	49.1	820	1,730	None	-	-	1,730	New plant	Inactive
South Loup River	25.2								
Arnold	122.3	900	900	Secondary	Sat.	Sat.	220	None	-
Callaway	100.6	600	600	Primary	Sat.	Sat.	450	None	-
Mud Creek	18.0								
Broken Bow	69.6	3,000	3,470	Secondary	Unsat.	Sat.	1,390	Enlarge	Inactive
Ravenna	15.4	1,600	2,170	None	-	-	2,170	New plant	Inactive
St. Paul	6.6	1,710	1,900	None	-	-	1,900	New plant	Inactive
North Loup River	67.5								
Burwell	64.2	800	1,100	None	-	-	1,100	New plant	Inactive
Ord	50.3	1,100	1,100	None	-	-	1,100	New plant	Inactive
Spring Creek	66.5								
Wolbach	10.6	400	400	Secondary	Sat.	Unsat.	80	None	-
Cedar River	40.0								
Spalding	53.0	800	800	None	-	-	800	New plant	Inactive
Cedar Rapids	30.9	600	600	None	-	-	600	New plant	Inactive
Fullerton	2.0	1,530	3,280	None	-	-	3,280	New plant	Inactive
Beaver Creek	25.1								
Albion	42.9	1,680	1,950	None	-	-	1,950	New plant	Inactive
St. Edward	22.6	890	890	None	-	-	890	New plant	Inactive
Genoa	2.6	1,000	1,000	None	-	-	1,000	New plant	Inactive
Columbus	0.2	7,070	9,070	Minor[2]	Unsat.	Unsat.	9,070	Replace	Inactive
Lost Creek	84.0								
Schuyler	4.0	2,500	2,500	None	-	-	2,500	New plant	Inactive
Shell Creek	83.5								
Newman Grove	69.7	890	2,580	Minor[2]	Unsat.	Unsat.	2,580	Replace	Inactive
Lindsay	62.8	100	100	Primary	Sat.	Sat.	80	Addition	Inactive
North Bend	72.8	1,100	1,100	Secondary[3]	Sat.	Unsat.	1,100	None	-
Cedar Bluffs	62.0	(b)	-	Primary	Sat.	Sat.	-	None	-
Elkhorn River	33.4								
Bassett	landlocked	800	800	Secondary	Sat.	Unsat.	400[a]	None	-
Stuart	269.5	400	400	Secondary	Sat.	Sat.	200	None	
Atkinson	258.0	1,200	1,200	None	-	-	1,200	New plant	Inactive
O'Neill	236.1	2,[illegible]	4,820	None	-	-	4,820	New plant	Inactive
Neligh	187.7	1,750	2,130	None	-	-	2,130	New plant	Inactive
Cedar Creek	181.9								
Elgin	20.7	800	800	Secondary	Sat.	Unsat.	200	None	-
Tilden	174.2	850	850	Minor[2]	Unsat.	Unsat.	850	Replace	Inactive
Buffalo Creek	167.7								
Meadow Grove	1.0	370	370	Primary	Sat.	Sat.	280	None	-
Battle Creek	156.7								
Battle Creek	1.7	700	700	Primary	Sat.	Sat.	520	None	-
Norfolk	143.5	11,700	21,560	None	-	-	21,560	New plant	Inactive
State Hospital, Norfolk	-	1,210	1,210	Secondary	Sat.	Sat.	250[d]	None	-
North Branch	141.8								
Wausa	50.0	750	750	Secondary	Sat.	Sat.	250	None	-
Plainview	40.0	1,430	1,430	Minor[2]	Sat.	Unsat.	1,140[a]	None	-
Osmond	25.0	700	700	Secondary	Sat.	Unsat.	700	None	-
Pierce	22.4	1,000	1,180	None	-	-	1,180	New plant	Inactive
Nameless Creek	5.0								
Hoskins	8.0	80	80	Secondary	Sat.	Sat.	30	None	-
Union Creek	128.7								
Madison	18.3	1,800	2,740	Minor[2]	Unsat.	Unsat.	2,740	Replace	Inactive
Meridian Creek	15.8								
Tracy Creek	4.5								
Humphrey	13.8	800	800	Minor[2]	Unsat.	Unsat.	800	Replace	Inactive
Stanton	127.2	930	1,260	None	-	-	1,260	New plant	Inactive
Pilger	110.5	550	550	None	-	-	550	New plant	Inactive
Wisner	98.3	1,260	1,260	None	-	-	1,260	New plant	Inactive
Beemer	89.0	580	580	None	-	-	580	New plant	Inactive
West Point	75.5	2,030	3,830	None	-	-	3,830	New plant	Inactive
Scribner	55.0	910	1,290	None	-	-	1,290	New plant	Inactive
Pebble Creek	53.1								
Dodge	19.8	650	650	Minor[2]	Unsat.	Unsat.	650	Replace	Inactive
Snyder	13.4	320	320	Primary	Sat.	Sat.	240	Addition	Inactive
Hooper	46.2	700	700	None	-	-	700	New plant	Inactive
Logan Creek	43.8								
Laurel	85.0	780	780	Minor[2]	Unsat.	Unsat.	780	Replace	Inactive
Nameless Creek	80.0								
Belden	10.0	150	150	Secondary	Sat.	Unsat.	40	None	-
Wakefield	60.0	1,150	1,150	None	-	-	1,150	New plant	Inactive
South Fork	60.0								
Randolph	25.0	900	900	Secondary	Sat.	Unsat.	750	None	-
Winside	19.4	400	400	None	-	-	400	New plant	Inactive
Wayne	9.6	4,000	4,770	None	-	-	4,770	New plant	Inactive
Thurston	48.0	150	150	Primary	Sat.	Sat.	100	None	-
Pender	44.6	1,350	2,650	None	-	-	2,650	New plant	Inactive
Lyons	24.8	1,000	1,670	None	-	-	1,670	New plant	Inactive
Oakland	17.0	1,330	1,540	None	-	-	1,540	New plant	Inactive
Maple Creek	34.8								
Leigh	64.0	580	580	Primary	Sat.	Sat.	430	Addition	Inactive
Clarkson	55.2	1,000	1,000	Primary	Sat.	Sat.	750	Addition	Inactive
Howells	46.7	600	600	Minor[2]	Sat.	Sat.	450	Addition	Inactive
Arlington	27.7	600	600	Secondary	Sat.	Sat.	240	None	-
Fremont	22.4	13,600	41,680	None	-	-	41,680	New plant	Inactive
Valley	15.1	1,000	1,000	Secondary	Sat.	Unsat.	400	None	-

Table LP-2. Lower Platte River Sub-Basin - Basic data on sources of municipal pollution (contd.)

Receiving stream, name and location of municipality[1]	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) untreated waste	Waste treatment provided	Adequacy of treatment facilities		Population equivalent discharged to watercourse	Project needs	Current status of municipal action
					Const.	Oper.			
Platte River									
Salt Creek	26.4								
Lincoln	25.0	85,000	132,500	Secondary	Unsat.	Sat.	53,000	Enlarge	Preliminary plans
Ashland	1.8	1,000	1,000	None	-	-	1,000	New plant	Inactive
Wahoo Creek	2.8								
Weston	33.2	100	100	None	-	-	100	New plant	Inactive
Wahoo	25.0	3,300	5,460	None	-	-	5,460	New plant	Inactive
Clear Creek	1.0								
Yutan	17.0	(b)		Secondary	Sat.	Sat.		None	-
Louisville	17.2	300	300	None	-	-	300	New plant	Inactive
Totals		342,610	362,320				236,150		

[1] All municipalities listed are in the State of Nebraska. Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

[2] Septic tank.

[3] Treatment plant not in operation.

[a] Discharge to ground - pollution reaches watercourse only during wet weather.

[b] New sewage system and treatment plant.

[c] Including industrial population equivalent of 2,930 which discharges to treatment plant outfall.

[d] Treatment plant effluent used for irrigation.

[e] Does not reach watercourse.

Table LP-3. Lower Platte River Sub-Basin - Basic data on sources of industrial pollution - Industries discharging wastes directly to watercourse

Receiving stream, name and location of industry[1]	River miles from mouth	Type of industry	Type of waste produced	Treatment or other pollution control measures		Population equivalent (B.O.D.) discharged to watercourse	Project needs or equivalent control measures	Current status of industrial action
				Degree	Adequacy			
Platte River								
Lexington Rendering Co. Lexington, Nebr.	252.0	Food and kindred products	Organic	None	-	940	New plant	Inactive
Lexington Locker Plant Lexington, Nebr.	252.0	Food and kindred products	Organic	None	-	110	New plant	Inactive
Frush Bros. Slaughterhouse House Lexington, Nebr.	252.0	Food and kindred products	Organic	None	-	280[a]	New plant	Inactive
Shirley Slaughter House Kearney, Nebr.	210.0	Food and kindred products	Organic	None	-	170	New plant	Inactive
Moore Slaughter House Kearney, Nebr.	210.0	Food and kindred products	Organic	None	-	150	New plant	Inactive
Kearney Packing Co. Kearney, Nebr.	210.0	Food and kindred products	Organic	None	-	1,960	New plant	Inactive
Wood River	161.8							
Ford Packing Co. Grand Island, Nebr.	13.0	Food and kindred products	Organic	Complete[2]	Adequate	(c)	None	-
Grand Island Rendering Co. Grand Island, Nebr.	13.0	Food and kindred products	Organic	Complete[2]	Adequate	(c)	None	-
Fair Acres Dairy Grand Island, Nebr.	13.0	Food and kindred products	Organic	Complete[3]	Adequate	(c)	None	-
American Crystal Sugar Refinery Grand Island, Nebr.	12.0	Food and kindred products	Organic	None	-	65,620	New plant	Inactive
Loup River	103.0							
Middle Loup River	67.5							
Oak Creek	14.9							
Creamland Creamery Dannebrog, Nebr.	0.6	Food and kindred products	Organic	None	-	290	New plant	Inactive
North Loup River	67.5							
City Market Slaughter House Burwell, Nebr.	64.0	Food and kindred products	Organic	None	-	350	New plant	Inactive
Ord Rendering Co. Ord, Nebr.	-	Food and kindred products	Organic	Complete[2]	Adequate	(c)	None	-
Ord Slaughter House Ord, Nebr.	50.0	Food and kindred products	Organic	None	-	340	New plant	Inactive
Columbus Rendering Co. Columbus, Nebr.	0.2	Food and kindred products	Organic	None	-	2,200	New plant	Inactive
Smith's Dairy Columbus, Nebr.	0.2	Food and kindred products	Organic	None	-	70[a]	New plant	Inactive
Elkhorn River	33.4							
Battle Creek	156.7							
Co-Op Creamery Battle Creek, Nebr.	2.0	Food and kindred products	Organic	None	-	180	New plant	Inactive
Roman Packing Co. Norfolk, Nebr.	143.0	Food and kindred products	Organic	None	-	3,640	New plant	Inactive
Norfolk Rendering Co. Norfolk, Nebr.	135.0	Food and kindred products	Organic	None	-	2,400	New plant	Inactive
West Point Rendering Co. West Point, Nebr.	75.0	Food and kindred products	Organic	None	-	580	New plant	Inactive
Logan Creek	43.8							
Wayne Rendering Co. Wayne, Nebr.	70.0	Food and kindred products	Organic	None	-	1,370	New plant	Inactive
Independent Rendering Co. Pender, Nebr.	44.0	Food and kindred products	Organic	None	-	380	New plant	Inactive
Roberts Dairy Waterloo, Nebr.	13.2	Food and kindred products	Organic	Secondary[d]	Inadequate	2,160	Addition	Inactive
Salt Creek	26.4							
Antelope Creek	26.0							
Cushman Scooter Co. Lincoln, Nebr.	3.0	Transportation Equipment	Organic and inorganic	None	-	(b)	New plant	Inactive
Total						83,190		

[1] Industries having separate outlets.

[2] Cess pools and/or ponds.

[3] Septic tank and tile field.

[a] Land application.

[b] Further study required.

[c] Does not reach watercourse.

[d] Not in operation.

MISSOURI-SOURIS RIVERS SUB-BASIN

This section is based upon the report "Missouri-Souris Development Area Water Pollution Investigation - A Cooperative State-Federal Report on Water Pollution" published in November 1951. Data were made current as of January 1, 1953, by the respective State Water Pollution Control Agencies of Montana, North Dakota, and South Dakota.

General Description

The Missouri-Souris Rivers Sub-Basin, for purposes of this report, encompasses the Souris River drainage area and the Devils Lake region in North Dakota, and the Missouri River watershed from below the mouth of Milk River in Montana to Spring Creek in South Dakota, excluding the Yellowstone River. This area embraces considerable portions of the States of North Dakota and Montana, and small sections of South Dakota and Wyoming. The Sub-Basin's 60,600 square miles sustain a population of 345,260. Those cities having populations over 5,000 are Bismarck, Dickinson, Williston, Mandan, Minot, and Devils Lake, all in North Dakota.

Agricultural pursuits and related activities are the basis of the region's economy. The principal farm income is from field crops as wheat, corn, sugar beets, potatoes, and forage, and livestock which are supported by the extensive prairies of the region. Related food processing plants--flour mills, packing houses, creameries, egg packing and poultry dressing establishments--thrive throughout the Sub-Basin.

Population growth was steady until the decade 1920 to 1930, when Montana showed a minor reduction. From 1930 to 1940 the States of South Dakota and North Dakota lost portions of their population. Stabilization of farming economy by development of irrigation through the comprehensive development plan for land and water resource conservation of the Missouri River Basin will do much to alleviate adverse effects of drough conditions.

Water Uses

The region considered in this report is generally deficient in water resources. With exception of major rivers, stream flow is low and frequently approaches zero; most minor tributaries are intermittent streams. Ground water levels have been lowering over a considerable period of time and water quality is poor. This situation has led to extensive use of available surface waters.

Surface water supplies are used by 9 communities or institutions serving 43,150 people with 4,090,000 gallons daily. Seventy-two municipalities secure water from the scarce and relatively inadequate ground sources and distribute 5,430,000 gallons each day to 73,500 persons. Most industrial water needs are met by the municipal systems. Two power plants and a sand and gravel company use considerable quantities of surface water. Thirty-two industrial establishments secure 1,255,000 gallons of water per day from wells.

Irrigation has not been a major factor in development of agriculture because of the success of dry-land farming and because of the cost and other difficulties associated with irrigation in this region. Recent resource conservation developments, coupled with land classification, indicate future extensive irrigation possibilities in some sections of the area. There are 40 irrigators in the Big Muddy Creek watershed and 9 in the Poplar River watershed in Montana, total acreage 3,600. In the Souris River watershed, 32 water rights dating from 1905 have been filed for irrigation use. Thirteen other recognized users do not have recorded water rights. Irrigated acreage totals 10,500. These data may not include all irrigators but present a general indication of the extent of irrigation practice.

Extensive use is made of surface waters for livestock water. In the Big Muddy Creek and Poplar River watersheds of Montana there are 2,250 acre-feet of stock-watering and minor capacity pools. The capacity of stock-watering impoundments in the Souris valley is estimated at 8,400 acre-feet.

Hydroelectric power units will be included in the Garrison Dam which is under construction on the Missouri, and may be included in the Missouri Diversion Dam below Fort Peck Reservoir which is being considered for construction. Other hydroelectric power installations are being evaluated.

Fishing is poor in most of the smaller streams. Many of the proposed impoundments may create improved fisheries. Fish and wildlife development is one of the multiple uses of Dickinson and Heart Butte Dams.

The area has a large wildlife population, particularly waterfowl. Numerous refuges under the purview of the Fish and Wildlife Service have been established. The Big Muddy Creek valley has one major national wildlife refuge, the Medicine Lake, containing several impoundments. There are three major national widlife refuges in the Souris valley, namely, the Des Lacs, Upper Souris, and Lower Souris, and a number of smaller ones in the Devils Lake area.

Existing recreational facilities are limited. In the planning of proposed and existing multiple-use reservoirs, recreation has been an important factor. Dickinson and Heart Butte Dams have provided excellent recreational developments, including boating, swimming, picnicking, and camping facilities. All proposed dams have recreation as one of their multiple uses. The value of clean waters, a bubbling brook, fish-abounding lakes, is being more and more recognized as of tremendous import to human well-being, emotional stability, and general happiness.

The water resources development plan proposes conservation of available surface and ground waters within the region and importation of water from the Missouri River. Irrigation is envisioned for areas adjacent to the streams within the Missouri watershed and for a considerable portion of the Souris drainage area. The plan proposes to supplement municipal and industrial water supplies for domestic, processing and sanitary uses. It will rehabilitate Devils and Stump Lakes and may enhance waterfowl production. It will greatly increase hydroelectric power and minimize the effects of floods.

Table MS-1. Missouri-Souris Rivers Sub-Basin - Probable frequency of low mean monthly discharge

Years of record	Stream and location	Drainage area square miles	Low mean monthly discharge in c.f.s. that may be expected once in: 2 yrs.	3 yrs.	5 yrs.	10 yrs.	Low mean monthly flow of record
	SUMMER (JUNE-SEPT)						
15	Redwater Creek at Circle, Mont.	534	0.0	0.0	0.0	0.0	0.0
12	Middle Fork Poplar River at International Boundary	381	0.2	0.2	0.1	0.0	0.0
10	Poplar River near Bredette, Mont.	2,840	13	5.9	2.4	1.0	0.8
12	East Fork Poplar River at International Boundary	296	2.7	2.2	1.6	0.7	0.6
12	West Fork Poplar River at International Boundary	141	0.0	0.0	0.0	0.0	0.0
9	West Fork Poplar River near Richland, Mont.	-	0.4	0.2	0.2	0.1	0.1
12	Little Missouri River near Alzada, Mont.	780	0.8	0.2	0.0	0.0	0.0
10	Little Missouri River at Marmarth, North Dakota	-	42	31	18	11	7.0
6	Little Missouri River at Medora, North Dakota	6,190	32	12	0.6	0.3	0.3
9	Little Missouri River near Watford City, N.D.	8,490	126	84	58	22	1.4
10	Little Beaver Creek near Marmarth, N.D.	-	1.7	0.2	0.0	0.0	0.0
8	Beaver Creek near Wibaux, Mont.	-	0.7	0.1	0.0	0.0	0.0
6	Knife River near Golden Valley, N.D.	1,230	9.1	7.8	6.1	4.3	4.0
10	Knife River at Hazen, N.D.	2,352	28	22	17	12	7.6
5	Heart River at Lehigh, N.D.	453	2.8	2.5	2.1	1.8	1.8
6	Heart River near Richardton, N.D.	1,310	10	6.6	2.5	0.8	0.49
5	Heart River near Glen Ullin, N.D.	1,760	14	13	8.2	3.4	3.4
10	Heart River near Mandan, N.D.	3,360	31	23	8.9	5.1	2.3
5	Cannonball River near New Leipzig, N.D.	1,260	4.3	3.6	3.2	2.8	2.8
9	Cannonball River at Breien, N.D.	4,066	13	8.4	7.2	2.8	0.2
5	Cedar Creek near Pretty Rock, N.D.	1,260	0.5	0.5	0.3	0.1	0.1
21	Missouri River at Williston, N.D.	164,500	13,440	11,760	9,780	7,310	4,690
47	Souris River above Minot, N.D.	11,300	6.3	1.0	0.3	0.0	0.0
18	Souris River near Westhope, N.D.	17,600	9.1	3.7	0.8	0.0	0.0
	WINTER (DEC.-FEB.)						
11	Redwater Creek at Circle, Mont.	534	0.0	0.0	0.0	0.0	0.0
11	Little Missouri River near Alzada, Mont.	780	0.2	0.1	0.0	0.0	0.0
9	Little Missouri River at Marmarth, N.D.	-	0.2	0.0	0.0	0.0	0.0
4	Little Missouri River at Medora, N.D.	6,190	4.3	2.1	1.3	0.7	0.8
9	Little Missouri River near Watford City, N.D.	8,490	0.2	0.0	0.0	0.0	0.0
9	Little Beaver Creek near Marmarth, N.D.	-	0.1	0.0	0.0	0.0	0.0
8	Beaver Creek near Wibaux, Mont.	-	0.3	0.2	0.2	0.1	0.0
5	Knife River near Golden Valley, N.D.	1,230	5.1	5.0	4.2	3.5	3.49
9	Knife River at Hazen, N.D.	2,352	11	7.6	6.7	6.3	6.0
4	Heart River at Lehigh, N.D.	453	2.4	1.3	0.9	0.6	0.72
5	Heart River near Richardton, N.D.	1,310	4.8	3.4	3	0.3	3
4	Heart River near Glen Ullin, N.D.	1,760	7.9	5.6	3.9	2.6	2.92
10	Heart River near Mandan, N.D.	3,360	3.6	1.4	0.4	0.0	0.0
4	Cannonball River near New Leipzig, N.D.	1,260	3.3	1.7	1.4	1.1	1.17
9	Cannonball River at Breien, N.D.	4,066	2.6	0.7	0.2	0.0	0.0
4	Cedar Creek near Pretty Rock, N.D.	1,260	1.4	1.0	0.8	0.7	0.75
20	Missouri River at Williston, N.D.	164,500	8,500	8,120	5,960	5,080	3,040
37	Souris River above Minot, N.D.	11,300	0.6	0.5	0.1	0.0	0.0
13	Souris River near Westhope, N.D.	17,600	0.0	0.0	0.0	0.0	0.0

A study of stream discharges was made to ascertain low flow frequencies. The low mean monthly flows for summer (June-September) and winter (December-February) were selected for each of the years of record and used as a basis for establishing low flow expectancies (table MS-1). These values are subject to modification on streams having or which will have comparatively large amounts of conservation storage. The possible occurrence of low flows may be utilized as a basis for treatment plant design and to determine the frequency of nuisance conditions in the stream. Data indicate that tributaries of the Missouri River experienced severe low flow conditions in the past with zero flows for prolonged periods. All tributary streams may be considered as having zero flows frequently enough to permit the assumption of absence of flow as a firm basis for sewage treatment design purposes.

Sources of Pollution

Data on sources of pollution tabulated in tables MS-2 and MS-3 and summarized in tables 1 and 2, Part I, show 81 municipalities with sewerage serving about 127,000 people. Industry connected to municipal sewerage increases the municipal wastes produced to an estimated population equivalent of 167,000. Sixty-eight, or 84 percent, of these communities provide treatment to produce an over-all reduction of pollution of 31 percent.

An estimated 6,000 population equivalents are discharged separately by 24 industries of which 6 provide adequate treatment measures. Recent discoveries of oil in eastern Montana and western North Dakota may introduce a new type of waste to the area. A refinery is being constructed at Mandan, North Dakota. The limited amounts of oil thus far brought in have not created pollution problems of great importance.

Needs have been established for municipalities as follows: 13 new plants, 13 replacements, 2 enlargements, and 2 additions. Nine industrial establishments will require new treatment facilities. The cost of constructing the recommended treatment facilities is conservatively estimated at $3,700,000 which includes neither interceptors, operation nor maintenance.

The respective State Health Departments recognize the need for a minimum of primary treatment and additional treatment where necessary. Montana and North Dakota have need for comprehensive water pollution control legislation. Wyoming has recently amended its laws to provide for a more comprehensive definition of pollution.

There is no significant interstate pollution in the Basin.

The pollution control activities of the State Water Pollution Control Agencies have been commensurate with financial support and statutory backing. Implications of a comprehensive water pollution control program, particularly where associated with water resources development, indicate need for active area-wide programs for pollution abatement with adequate funds and supporting legislation. An excellent record in pollution control has in the past been achieved by the State agencies as evidenced by the number of communities having sewage treatment facilities.

Table MS-2. Missouri-Souris Rivers Sub-Basin - Basic data on sources of municipal pollution

Receiving stream, name, and location of industry[1]	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) of untreated wastes	Waste treatment provided	Adequacy of treatment facilities Capy.	Adequacy of treatment facilities Oper.	Population equivalent discharged to watercourse	Project needs	Current status of municipal action
I - Missouri River									
Wolf Point, Mont.	1802.1	2,300	2,400	Minor[a]	Unsat.	Sat.	1,800	Replace	Inactive
Red Water Creek	1777.8								
Circle, Mont.	79.6	600	600	Minor[a]	Sat.	Unsat.	(600)[b]	Replace	Planning initiated
Poplar River	1775.8								
Scobey, Mont.	96.1	1,450	1,450	Primary	Unsat.	Sat.	1,000	Enlarge	Inactive
Poplar, Mont.	1775.3	1,000	1,000	Primary	Sat.	Unsat.	1,000	None	-
Big Muddy Creek	1726.7								
Plentywood, Mont.	99.0	1,600	1,600	None	-	-	1,600	New plant	Plans under preparation
Medicine Lake, Mont.	58.0	350	350	Minor[a]	Unsat.	Sat.	300	Enlarge	Inactive
Culbertson, Mont.	1715.1	700	700	Secondary	Sat.	Unsat.	200	None	-
Shotgun Creek	1700.0								
Bainville, Mont.	6.0	280	280	Primary	Sat.	Sat.	160	None	-
Williston, N. Dak.	1644.2	6,000	6,810	None	-	-	6,810	New plant	Inactive
Little Muddy Creek	1643.4								
Wild Rose, N.Dak.	65.0	(400)[c]	-	(Lagoon)[c]	-	-	-	-	-
Grenora, N.Dak.	52.0	520	520	Lagoon	Sat.	Sat.	(d)	None	-
Timber Creek	1631.0								
Arnegard, N.Dak.	22.0	100	100	Primary	Sat.	Sat.	(80)[b]	None	-
Beaver Creek	1590.0								
Tioga, N.Dak.	34.0	1,000	1,000	Primary	Sat.	Sat.	(680)[b]	None	-
Ray, N.Dak.	30.0	480	480	Primary	Sat.	Sat.	330	None	-
White Earth River	1579.0								
Powers Lake, N.Dak.	40.0	320	320	Primary	Sat.	Unsat.	(300)[e]	None	-
Little Knife River	1563.0								
Stanley, N.Dak.	23.0	1,200	1,320	Primary	Unsat.	Sat.	990	Addition	Inactive
New Town, N.Dak.	1560.0	350	350	Lagoon	Sat.	Sat.	(d)	None	-
Shell Creek	1525.0								
Parshall, N.Dak.	21.0	750	750	Primary	Sat.	Sat.	650	None	-
Little Missouri River	1506.8								
Marmarth, N.Dak.	306.4	400	400	Minor[a]	Unsat.	Unsat.	400	Replace	Inactive
Little Beaver Creek	306.4								
Ekalaka, Mont.	32.0	400	400	Secondary	Sat.	Sat.	100	None	-
Beaver Creek	137.5								
Beach, N.Dak.	73.0	1,100	1,100	Minor[a]	Unsat.	Unsat.	(1,100)[b]	Replace	Under construction
Wibaux, Mont.	62.5	500	500	Minor[a]	Sat.	Sat.	480	None	-
Cherry Creek	60.5								
Watford City, N.Dak.	30.0	1,200	1,300	Primary	Sat.	Sat.	1,000	None	-
Max, N.Dak.	Landlocked	500	300	Lagoon	Sat.	Sat.	(d)	None	-
Garrison, N.Dak.	1462.0	900	900	Primary	Sat.	Sat.	540	None	-
Riverdale, N.Dak.	1455.0	2,000	2,000	None	-	-	2,000	New plant	Inactive
Underwood, N.Dak.	1446.0	700	780	Primary	Sat.	Sat.	520	None	-
Knife River	1440.6								
Little Knife River	62.0								
Richardton, N.Dak.	80.0	530	600	Primary	Sat.	Sat.	(420)[b]	None	-
Hebron, N.Dak.	60.0	1,300	1,670	Secondary	Sat.	Sat.	420	None	-
Spring Creek	36.8								
Killdeer, No.Dak.	75.6	580	560	Primary	Sat.	Sat.	400	None	-
Zap, N.Dak.	11.0	300	300	Primary	Sat.	Sat.	200	None	-
Beulah, N.Dak.	32.0	1,000	1,000	Minor[a]	Unsat.	Unsat.	850	Replace	Inactive
Hazen, N.Dak.	12.5	1,000	1,000	Primary	Sat.	Unsat.	780	None	-
Stanton, N.Dak.	0.5	500	500	None	-	-	500	New plant	Inactive
Washburn, N.Dak.	1418.5	1,200	1,200	None	-	-	1,200	New plant	Inactive
Painted Woods Creek	1412.6								
Turtle Lake, N.Dak.	3.0	600	2,100	Primary	Sat.	Sat.	(1,500)[e]	None	-
Burnt Creek	1380.0								
Wilton, N.Dak.	24.0	800	840	Primary	Sat.	Sat.	450	None	-
Bismarck, N.Dak.	1377.0	19,000	21,700	None	-	-	21,700	New plant	Inactive
Heart River	1373.3								
Belfield, N.Dak.	235.0	1,250	1,250	Primary	Sat.	Sat.	1,000	None	-
Dickinson, N.Dak.	201.3	6,000	7,050	Secondary	Unsat.	Unsat.	3,500	Addition	Inactive
Antelope Creek	86.0								
Elgin, N.Dak.	28.0	400	400	Primary	Sat.	Sat.	(200)[b]	None	-
Carson, N.Dak.	16.0	350	350	Primary	Sat.	Sat.	(260)[b]	None	-
Muddy Creek	63.0								
Glen Ullin, N.Dak.	48.0	900	1,060	Primary	Sat.	Sat.	(740)[b]	None	-
Sweetbriar Creek	18.3								
New Salem, N.Dak.	17.0	800	890	Primary	Sat.	Sat.	(800)[b]	None	-
State Training School, N.Dak.	8.8	280	550	None	-	-	550	New plant	Inactive
Mandan, N.Dak.	7.0	8,000	18,000	None	-	-	18,000	New plant	Inactive
Apple Creek	1365.1								
Ft. Lincoln, N.Dak.	9.0	200	200	None	-	-	200	New plant	Final plans approved
Cannonball River	1333.4								
New England, N.Dak.	274.8	1,000	1,740	Minor[a]	Unsat.	Unsat.	1,740	Replace	Inactive
Regent, N.Dak.	239.1	350	350	Primary	Sat.	Sat.	200	None	-
Mott, N.Dak.	214.7	900	1,260	Minor[a]	Unsat.	Unsat.	1,070	Replace	Planning initiated
New Leipzig, N.Dak.	171.6	400	400	Primary	Sat.	Sat.	270	None	-
Cedar Creek	78.4								
Lemmon, S.Dak.	95.0	2,500	2,500	Secondary[f]	Sat.	Sat.	850	None	-
Beaver Creek	1321.0								
Wishek, N.Dak.	90.0	1,100	1,340	Lagoon	Sat.	Sat.	(d)	None	-
Napoleon, N.Dak.	Landlocked	250	540	Primary	Sat.	Sat.	(350)[e]	None	-
Linton, N.Dak.	22.0	1,600	2,550	Secondary	Sat.	Sat.	510	None	-
Ft. Yates, N.Dak.	1307.6	550	550	Primary	Sat.	Sat.	400	None	-
Steele, N.Dak.	Landlocked	480	480	Primary	Sat.	Sat.	(320)[e]	None	-
Ashley, N.Dak.	Landlocked	1,140	1,750	Primary	Sat.	Sat.	(1,170)[e]	None	-
Strasburg, N.Dak.	Landlocked	420	420	Primary	Sat.	Sat.	(320)[e]	None	-
II - Souris River	(g)								
Long Creek	(h)								
Nameless Creek	30.0								
Crosby, N.Dak.	12.0	1,500	1,680	Minor[a]	Unsat.	Sat.	(1,430)[e]	Replace	Inactive
Nameless Creek	8.0								
Noonan, N.Dak.	22.0	280	280	Primary	Sat.	Unsat.	(280)[e]	None	-
Short Creek	(h)								
West Branch	(h)								
Nameless Creek	7.0								
Columbus, N.Dak.	10.0	300	300	Primary	Sat.	Sat.	(200)[b]	None	-
Des Lacs River	242.5								
Nameless Creek	85.0								
Flaxton, N.Dak.	12.0	300	300	Lagoon	Sat.	Sat.	(d)	None	-
Stony Creek	66.0								
Bowbells, N.Dak.	7.0	500	650	Minor[a]	Sat.	Unsat.	(420)[b]	None	-
Kenmare, N.Dak.	56.0	1,200	3,500	None	-	-	3,500	New plant	Inactive
Minot, N.Dak.	220.0	20,000	27,780	Secondary	Sat.	Sat.	4,000	None	-
Velva, N.Dak.	178.0	1,110	1,320	None	-	-	1,320	New plant	Inactive
Wintering River	130.5								
Butte, N.Dak.	45.0	250	250	Secondary[f]	Sat.	Sat.	(70)[b]	None	-
Drake, N.Dak.	30.0	1,050	1,350	Minor[a]	Unsat.	Unsat.	(1,350)[e]	Replace	Planning initiated
Towner, N.Dak.	102.0	600	1,600	None	-	-	1,600	New plant	Inactive

Table MS-2. Missouri-Souris Rivers Sub-Basin - Basic data on sources of municipal pollution (cont.)

Receiving stream, name, and location of industry[1]	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) of untreated wastes	Waste treatment provided	Adequacy of treatment facilities		Population equivalent discharged to watercourse	Project needs	Current status of municipal action
					Desn.	Oper.			
II - Souris River (cont.)									
Willow Creek	57.0								
San Haven, State Hosp. N.D.	55.0			Primary	Sat.	Sat.		None	-
Ox Creek	22.0								
Rolla, N.Dak.	63.0	1,200	1,200	Minor[a]	Unsat.	Unsat.	(1,200)[e]	Replace	Inactive
Belcourt, Indian Agency Hq. No.Dak.	57.0	400	400	Primary	Sat.	Sat.	(250)[b]	None	-
Oak Creek	13.0								
Bottineau, N.Dak.	21.0	3,520	3,520	Primary	Sat.	Sat.	(2,300)[b]	None	-
Snake Creek	6.0								
Nameless Creek	30.0								
Rugby, N.Dak.	12.0	3,600	3,600	Secondary	Sat.	Sat.	(900)[e]	None	-
Cut Bank Creek	28.0								
Deep Creek	16.0								
Spring Coulee	7.0								
Mohall, N.Dak.	60.0	800	1,270	Minor[a]	Unsat.	Unsat.	(1,270)[b]	Replace	Inactive
Nameless Coulee	15.0								
Westhope, N.Dak.	5.0	500	500	None	-	-	500	New plant	Planning initiated
III - Devils Lake Area									
Cando, N.Dak.	Not applicable	1,800	3,120	Minor[a]	Unsat.	Unsat.	(2,650)[e]	Replace	Inactive
Devils Lake, N.Dak.	No defined	8,000	11,650	Minor[a]	Unsat.	Unsat.	10,000	Replace	Inactive
Lakota, N.Dak.	drainage	1,100	1,660	Lagoon	Sat.	Sat.	(d)	None	-
Leeds, N. Dak.		1,000	1,000	Secondary	Sat.	Unsat.	1,000	None	-
Totals		126,880	166,510				114,650		

[1] Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

[a] Septic tank.

[b] Discharge to intermittent creek--pollution reaches watercourse only during periods of high water.

[c] New system--population served is not included in the column total.

[d] Discharge to an artificial lagoon--no outlet to watercourse.

[e] Discharge to slough--drainage to watercourse indefinite or not existent and primarily of local significance.

[f] Oxidation ponds.

[g] River miles in this sub-basin represent distance from International Boundary.

[h] Mouth in Canada.

Table MS-3. Missouri-Souris Rivers Sub-Basin - Basic data on sources of industrial pollution - Industries discharging wastes directly to watercourse

Receiving stream, name, and location of industry[1]	River miles from mouth	Type of industry	Type of waste produced	Treatment or other pollution control measures		Population equivalent (B.O.D.) discharged to watercourse	Project needs	Current status of industrial action
				Degree	Adequacy			
I - Missouri River								
Ryder Co-Op Creamery Ryder, N.Dak.	Landlocked	Food & kindred products	Organic	Minor[a]	Adequate	(800)[b]	None	-
Snake Creek	1460.0							
Custer Coal Mine Near Garrison, N.Dak.	15.0	Lignite mining	Mine drainage	None	-	Not applicable	None[c]	-
Knife River	1440.6							
Spring Creek	56.6							
Bosch Meat Co. Halliday, N. Dak.	44.5	Food & kindred products	Organic	Minor[a]	Adequate	(d)	None	-
Bismarck Abattoir Bismarck, N. Dak.	1377.4	Food & kindred products	Organic	None	-	780	New plant	Inactive
Heart River	1373.3							
Andy's Coal Mine Belfield, N. Dak.	255.0	Lignite mining	Mine drainage	None	-	Not applicable	New plant	Inactive
Queen City Packing Co.	200.5	Food & kindred products	Organic	None	-	1,700	New plant	Inactive
Dakota Briquette & Tar Prod.Co.	186.0	Coal products	Inorganic	Lagoon	Adequate	(e)	None	-
Dickinson Coal Mine Co. Dickinson, N. Dak.	184.0	Lignite mining	Mine drainage	None	-	Not applicable	New plant	Inactive
Armour & Co. Sunnyside, N. Dak.	15.7	Food & kindred products	Organic	None	-	(f)	None	-
Mandan Livestock Sales Co.	8.0	Food & kindred products	Organic	None	-	(f)	None	-
Miller & Swanick Co.	8.0	Food & kindred products	Organic	Minor[a]	Adequate	(d)	None	-
Russel Miller Milling Co. Mandan, N. Dak.	8.0	Food & kindred products	Organic	None	-	360	New plant[g]	Inactive
Apple Creek	1365.1							
Northern Hide & Fur Co. Bismarck, N. Dak.	6.0	Food & kindred products	Organic	None	-	(d)	None	-
Beaver Creek	1320.5							
Linton Slaughterhouse Linton, N. Dak.	31.0	Food & kindred products	Organic	None	-	250	New plant	Inactive
II - Souris River	(h)							
Short Creek	(i)							
West Branch	(i)							
Baukal Noonan, Inc. Near Noonan, N. Dak.	11.0	Lignite mining	Mine drainage	None	-	(c)	None	-
Nameless Creek	7.0							
Columbus Cold Storage Co. Columbus, N. Dak.	10.0	Food & kindred products	Organic	None	-	(f)	None	-
Tributary	6.0							
Truax Coal Co. Near Columbus, N. Dak.	10.0	Lignite mining	Mine drainage	None	-	(c)	None	-
Minot Sand & Gravel Co.	232.0	Miscellaneous	Inorganic	Partial	Adequate	Not applicable	None	-
Northwest Rendering Co.	225.0	Food & kindred products	Organic	Lagoon	Adequate	(e)	None	-
Eatmore Sausage Co. Minot, N. Dak.	220.0	Food & kindred products	Organic	None	-	1,940	New plant[g]	Abatement ordered
Truax Mining Co.	188.3	Lignite mining	Mine drainage	None	-	Not applicable	New plant	Inactive
Joe Feist Co. Velva, N. Dak.	176.0	Food & kindred products	Organic	None	-	180	New plant	Inactive
Willow Creek	57.0							
Snake Creek	6.0							
Nameless Creek	30.0							
Red Owl Agency Rugby, N. Dak.	12.0	Food & kindred products	Organic	None	-	(f)	None	-
Cut Bank Creek	29.0							
Sherwood Creamery Assn. Sherwood, N. Dak.	110.0	Food & kindred products	Organic	None	-	(f)	None	-
Totals						6,010		

[1] Industries having separate outlets.

[a] Septic tank.

[b] To local lake.

[c] Discharge to intermittent creek--pollution reaches watercourse only during periods of high water.

[d] Sub-surface disposal--no waste reaches watercourse.

[e] Discharge to artificial lagoon--no outlet to watercourse.

[f] Land application--no waste reaches watercourse.

[g] Or connect to municipal sewer system.

[h] River miles in this sub-basin represent distance from International Boundary.

[i] Mouth in Canada.

NIOBRARA RIVER SUB-BASIN

The basis for this section is the "Niobrara River Basin Water Pollution Investigation" published January 1951. The data of this cooperative State-Federal report were made current as of January 1, 1953, by the State Health Departments of Nebraska, South Dakota, and Wyoming.

General Description

The Niobrara River Sub-Basin encompasses the Niobrara River and Ponca Creek watersheds. The Niobrara River rises in eastern Wyoming and flows eastward 431 miles through northern Nebraska to its confluence with the Missouri River. Ponca Creek has its source in southeastern South Dakota and flows to Nebraska through a narrow valley to the Missouri River. The 12,800 square miles of the Sub-Basin support a population of 65,000. Only 6 communities have populations exceeding 1,000.

The Sub-Basin is almost entirely dependent upon an agricultural economy, with livestock production the largest source of income. Irrigation has not been instituted on a large scale. The first major irrigation venture, Mirage Flats Development, provides water for 12,000 acres. The program of land and water resource development in the watershed will permit additional irrigation and improve crop production.

Water Uses

Public water supplies for domestic and industrial use are generally obtained from ground sources. Twenty-six community systems serve 16,810 people with 3,151,000 gallons per day. The Sand Hills region reportedly has a vast subsurface reservoir underlying its porous cover which provides an adequate supply of ground water.

The Mirage Flats project is the only major existing irrigation development in the area; however, the Bureau of Reclamation is conducting studies to determine the feasibility of developing additional units. Well irrigation has been increasing.

Most livestock is watered from numerous small natural ponds and lakes which prevail in the Sand Hills.

Five hydroelectric power plants are in operation at the present time, two on the main stem of the Niobrara and three on tributaries. The resource conservation program envisages hydroelectric power development at several additional locations.

Recreational use of surface waters is limited and primarily of local significance. The construction of dams will increase the recreational potential.

The Niobrara River is noted for uniformity of flow. The discharge of streams receiving ground inflow from the Sand Hills is perennially uniform, that is annual discharges show but slight variation. The results of low flow studies are depicted in table N-1 and may be used as a basis

Table N-1. Niobrara River Sub-Basin - Probable frequency of low mean monthly discharges

Years of Record	Stream and Location	Miles to mouth Niobrara River	Minimum monthly mean flows in cubic feet per second that may be expected once in: 2 years	3 years	5 years	10 years	Minimum
	SUMMER (JUNE-SEPT.)						
	Niobrara River						
18	Spencer, Nebraska	38	840	810	790	560	440
3	Sparks, Nebraska	139	650	640	640	640	640
2	Near Cody, Nebraska	196	250	250	250	250	250
6	Near Gordon, Nebraska	260	87	85	82	77	77
2	Near Colclesser, Nebraska	273	39	39	39	39	39
2	Below Box Butte, Nebraska	306	35	25	22	22	22
2	Marsland, Nebraska	320	17	14	13	13	13
	WINTER (DEC.-FEB.)						
	Niobrara River						
17	Spencer, Nebraska	38	920	860	790	700	620
3	Sparks, Nebraska	139	730	720	710	710	710
2	Near Cody, Nebraska	196	320	320	320	320	320
6	Near Gordon, Nebraska	260	120	110	94	82	81
2	Near Colclesser, Nebraska	273	40	40	40	40	40
2	Below Box Butte, Nebraska	306	1	1	1	1	1
2	Marsland, Nebraska	320	44	44	44	44	44

for sewage treatment plant design. Computation of the probable frequency of low mean monthly flows entailed selection by years of the lowest monthly flow in the summer and winter periods. Ponca Creek flow may approach zero for extended times.

Sources of Pollution

Sources of pollution are neither large nor many in number, reflecting the sparsely settled, rural characteristics of the Sub-Basin. Eleven municipalities provide sewerage to 9,800 persons and to connected industry. The total amount of wastes produced has a population equivalent of about 12,000. Treatment is provided at 8 towns (72.7 percent) affecting an over-all reduction in pollution of 46.7 percent. One industrial plant discharges untreated wastes having a population equivalent of 520. These data are tabulated in tables N-2 and N-3 and summarized in tables 1 and 2, Part I.

Needs for municipalities have been established as 3 new plants and 4 additions or enlargements; 1 new industrial waste treatment plant is necessary. The cost of recommended treatment facilities, not including interceptors, maintenance or operation, is conservatively estimated at $300,000.

Water pollution control activities of the States of the Basin have been commensurate with water use, financial support and legal backing. A comprehensive water pollution control law is urgently needed in Nebraska. There is no significant interstate pollution.

Table 8-2. Niobrara River Sub-Basin - Basic data on sources of municipal pollution

Receiving stream, name and location of municipality[1]	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) untreated waste	Waste treatment provided	Adequacy of treatment facilities Oper.	Adequacy of treatment facilities Capy.	Population equivalent discharged to watercourse	Project needs	Current status of municipal action
Missouri River									
Ponca Creek	838.6								
Gregory, S. Dak.	75.0	1,180	1,180	Primary	Sat.	Sat.	680	Addition	Inactive
Butte, Nebr.[2]	45.0	-	-	Secondary	Sat.	Sat.	-	None	-
Spencer, Nebr.	35.0	480	480	None	-	-	480	New plant	Inactive
Niobrara River	843.3								
Manville, Wyo.	425.0	150	150	None	-	-	150	New plant	Inactive
Lusk, Wyo.	420.0	1,000	1,200	Secondary	Sat.	Unsat.	480	None	-
Rush Creek	286.0								
Hay Springs, Nebr.	17.0	600	600	Primary	Sat.	Sat.	300	Addition	Inactive
Rushville, Nebr.	13.0	1,000	1,000	Secondary	Unsat.	Sat.	300	Enlarge	Inactive
Antelope Creek	241.0								
Gordon, Nebr.	12.0	1,500	1,500	Secondary	Unsat.	Sat.	650	Enlarge	Inactive
Minnechaduza Creek	148.0								
Valentine, Nebr.	4.0	2,000	2,160	None	-	-	2,160	New plant	Inactive
Long Pine Creek	96.0								
Long Pine, Nebr.	17.0	600	800	Primary	Sat.	Sat.	520	None	-
Bone Creek	13.0								
Ainsworth, Nebr.	19.0	1,100	2,970	Secondary	Sat.	Sat.	890	None	-
Totals		9,610	12,040				6,610		

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[1] Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

[2] New system and treatment plant - no further data available.

Table 8-3. Niobrara River Sub-Basin - Basic data on sources of industrial pollution - Industries discharging wastes directly to watercourses

Receiving stream, name and location of industry[1]	River miles from mouth	Type of industry	Type of waste produced	Treatment or other pollution control measures Degree	Treatment or other pollution control measures Adequacy	Population equivalent (B.O.D.) discharged to watercourse	Project needs or equivalent control measures	Current status of industrial action
Niobrara River								
Verdigre Creek	5.0							
Verdigre Creamery and Locker Plant[2] Verdigre, Nebr.	9.0	Food & kindred products	Organic	None	-	520	New plant	Inactive

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[1] Industries having separate outlets.

[2] School contributes an additional unknown amount of waste to this system.

NORTH PLATTE RIVER SUB-BASIN

The data as presented herein originates from the "North Platte River Basin Water Pollution Investigation", a cooperative State-Federal report published in January 1951. The factual information was revised by the State Health Departments of Colorado, Nebraska, and Wyoming to make it current as of January 1, 1953.

General Description

The North Platte River Sub-Basin, with an area of 37,400 square miles, extends from north central Colorado to southeastern Wyoming and western Nebraska. The North Platte rises in Colorado, flows in a northerly direction about 250 miles where it turns northeasterly for 50 miles past Casper Mountain. Below Casper, Wyoming, it progresses eastwardly for about 50 miles and then takes a southeasterly course to its confluence with the South Platte to form the Platte River east of the City of North Platte, Nebraska.

The Sub-Basin has a population of about 130,000; the largest cities are Scottsbluff, Nebraska, and Casper and Laramie, Wyoming.

Early history of the area indicates that the first economy was based on raising of livestock. Later large quantities of oil were located and a sizable oil producing and refining industry was established. Within the last 50 years extensive irrigation has been practiced, the principal crops being cereal grains and sugar beets. One of its really great natural resources, however, is water. Flows of the North Platte and tributaries are impounded in numerous places along its course for developing vast amounts of power, and for regulating the stream for irrigation. The water has added also to the recreational value of the mountainous sections of the Sub-Basin. It is claimed that the North Platte River is the most used stream in the United States.

Precipitation varies from 18 inches at the eastern extremity of the region to 15 inches in the vicinity of the foothills; greater rainfall occurs in the mountains. Irrigation is intrinsically involved with the economy of the region. Land and water resource conservation, currently practiced and planned for the future, will tend towards stabilization of the economy.

Water Uses

Lack of sufficient rainfall places a premium on water resources. In general, adequate ground water supplies are available for municipal use. Thirty-one communities with ground water sources serve 72,560 people with 12,262,000 gallons each day. In Wyoming, five communities with a total population served of 2,500 use 760,000 gallons of water from surface sources. Continued growth of Rawlins, Casper, and Glenrock, Wyoming, may make necessary their resort to surface sources for additional water.

Industry, not connected to municipal systems, generally uses surface waters which may, in some instances be supplemented by well supplies.

Industrial consumption reportedly exceeds 60,000,000 gallons per day.

Irrigation was introduced in the 1850s. At first, only natural river flows were utilized. In 1909, the Reclamation Service put Pathfinder Dam, with a storage capacity of 1,045,000 acre-feet, into operation. Further development led to construction of Guernsey Reservoir in 1927. Nearly 1,000,000 acres are now under irrigation.

The five existing hydroelectric power plants have a generating capacity of about 100,700 kilowatts. The North Platte River has a potential capacity of an additional 321,500 kilowatts.

Recreational facilities are numerous in the Colorado and Wyoming areas adjacent to the Rocky Mountain Region. Fish and wildlife habitat in the headwaters present ideal conditions for the sportsman and trapper. Above Seminoe Reservoir the North Platte River and tributaries are noted for trout fishing. However, deposition of sediment and discharge of industrial wastes make the stream unfit for fishes from Casper, Wyoming, to about 110 miles downstream.

The present program for maximum beneficial use of water resources in the Sub-Basin, as developed by the Bureau of Reclamation, includes extension of existing irrigation systems, development of additional hydroelectric power, provisions for additional recreational facilities, fish and wildlife improvements, and public health and sanitation benefits. Twenty dams and reservoirs are under consideration.

Expected frequencies of low mean monthly stream flows for summer and winter seasons, based upon historic flows, have been evaluated. Minimum flows as well as the probable mean minimum monthly discharges expected in 2, 3, 5, and 10 years are presented in table NP-1. Low flow data provide a firm basis for sewage treatment evaluation and treatment plant design.

Sources of Pollution

Pollution of streams, as it affects vital water resources, is becoming more and more of concern to municipal and State officials and to management of industry. Pollution data for municipalities and industry are tabulated in tables NP-2 and NP-3, and summarized in tables 1 and 2, Part I.

Thirty-three municipalities serving a total population of 89,140 produce wastes having a population equivalent of 160,480. Treatment is provided by 12 communities which reduces the over-all municipal pollution by only 2.4 percent. Of 22 industries with separate outlets, 6 provide some degree of treatment although only one industry uses adequate control measures. An estimated 1,916,570 population equivalents are discharged by industry when the seasonal beet sugar refineries are operating.

Pollution control problems are aggravated by the seasonal character of the beet sugar industry. Five plants discharge wastes during the fall and early winter campaign having a population equivalent of 1,840,000. Five oil refineries discharge wastes after passage through oil water separators; the adverse effects of toxic wastes have been detected. One oil company lagoons all wastes so that no pollutants reach the watercourse.

Table NP-1. North Platte River Sub-Basin - Probable frequency of low mean monthly discharges

Years of Record	Stream and Location	Miles to mouth: North Platte River	Miles to mouth: Tributary	Drainage Area Square Miles[a]	Minimum monthly mean flows in cubic feet per second that may be expected once in: 2 years	3 years	5 years	10 years	Minimum
	SUMMER (JUNE-SEPT)								
	North Platte River Basin								
29	Near Walden, Colo.	665		469	38	32	29	20	12
17	Near Northgate, Colo.	651		1,440	82	79	70	43	25
17	Saratoga, Wyo.	579		2,880	200	160	150	110	67
17	Near Sinclair, Wyo.	530			210	180	160	140	66
31	Inflow Seminoe Reservoir	523			320	220	180	170	40
7	Medicine Bow River-10 mi. N. of Hanna, Wyo.	495			14.5	10	9	7	6
17	Outflow Seminoe Reservoir	482			280	220	220	70	40
17	Inflow Pathfinder Reservoir	466		8,524	390	270	210	130	97
17	Outflow Pathfinder Reservoir	452			700	500	370	120	82
9	Inflow Alcova Reservoir	446			540	520	300	140	150
17	Alcova Reservoir release to North Platte Riv.	442			2,100	1,600	1,400	340	420
9	Below Alcova Reservoir	442		10,800	1,400	1,100	640	340	180
17	Below Casper, Wyo.	392		12,600	1,500	870	640	450	140
17	Douglas, Wyo.	365		14,300	1,600	1,000	790	470	130
17	Inflow Guernsey Reservoir	265			2,000	1,500	1,100	450	180
17	Below Guernsey Reservoir	251		16,200	2,200	1,500	1,200	400	250
17	Below Whalen Dam	243			360	280	150	100	66
17	Below Whalen, Wyo.	242			350	240	140	100	64
10	Laramie River near Ft. Laramie, Wyo.	232	2		35.7	21.0	16.8	13.4	4.1
	Laramie River near Laramie, Wyo.	232	135		10.0	6.4	4.0	2.9	2.6
	Rawhide Creek near Lingle, Wyo.	217			25.2	20.7	15.1	8.4	8.0
17	Wyoming-Nebraska State Line	200			790	700	660	440	160
17	Tri-State Diversion Dam	198			96	30	25	20	17
	Horse Creek near Lyman, Nebr.	194			62.0	50.4	20.5	16.0	6.1
17	Mitchell, Nebr.	184		24,300	260	220	150	90	80
17	Minatare, Nebr.	166			320	280	240	96	38
17	Bridgeport, Nebr.	142		25,300	430	400	320	120	85
15	Lisco, Nebr.	113		26,900	440	360	310	120	87
17	Oshkosh, Nebr.	96		27,500	420	330	270	100	17
17	Alcova Reservoir Routing[a]	442			1,300	640	100	100	100
17	Glendo Storage[a]	280			1,000	1,000	1,000	1,000	1,000
	WINTER (DEC-FEB)								
	North Platte River Basin								
2	Near Walden, Colo.	665		469	Two year record inadequate				
17	Near Northgate, Colo.	651		1,440	57	47	40	35	33
17	Saratoga, Wyo.	579		2,880	230	200	190	170	150
17	Near Sinclair, Wyo.	530			240	220	210	150	140
31	Inflow Seminoe Reservoir	523			310	280	230	220	190
7	Medicine Bow River-10 mi. N. of Hanna, Wyo.	495			24	20	16	13	12
17	Outflow Seminoe Reservoir	482			270	250	220	200	180
17	Inflow Pathfinder Reservoir	466		8,524	350	310	280	230	210
17	Outflow Pathfinder Reservoir	452			25	0	0	0	0
8	Inflow Alcova Reservoir	446			13	8.4	3.3	1.7	0
	Alcova Reservoir release to North Platte Riv.	442			No release in winter				
8	Below Alcova Reservoir	442		10,800	3.3	3.3	0.3	0	0
7	Below Casper, Wyo.	392		12,600	70	65	60	55	50
7	Douglas, Wyo.	365		14,300	120	110	110	100	80
17	Inflow Guernsey Reservoir	265			180	160	130	120	120
17	Below Guernsey Reservoir	251		16,200	190	150	120	90	25
17	Below Whalen Dam	243			35	17	10	5.0	1.7
17	Below Whalen, Wyo.	242			34	12	6.7	5.0	[illegible]
10	Laramie River near Ft. Laramie, Wyo.	232	2		14.1	8.7	6.4	6.4	6.1
	Laramie River near Laramie, Wyo.	232	135		No record				
	Rawhide Creek near Lingle, Wyo	217			14.6	12.9	9.3	8.3	7.7
17	Wyoming-Nebraska State Line	200			410	350	330	280	280
17	Tri-State Diversion Dam	198			400	350	320	280	270
	Horse Creek near Lyman, Nebr.	194			18.2	16.4	15.8	12.3	7.6
17	Mitchell, Nebr.	184		24,300	590	530	450	430	420
17	Minatare, Nebr.	166			860	770	610	590	540
17	Bridgeport, Nebr.	142		25,300	1,040	990	810	760	730
15	Lisco, Nebr.	113		26,900	1,200	1,000	940	840	840
17	Oshkosh, Nebr.	96		27,500	1,300	1,100	1,100	930	910
17	Alcova Reservoir Routing[a]	442			1,000	1,000	1,000	920	820
17	Glendo Storage[a]	280			4,300	4,300	4,300	4,300	4,000

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[a] Based upon proposed Glendo Reservoir Operation - tentative basin studies not yet completed which would supplant these figures indicate a minimum flow of 500 c.f.s. between Bessemer Bend and Glendo.

Table NP-2. North Platte River Sub-Basin - Basic data on sources of municipal pollution

Receiving stream, name and location of municipality[1]	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) untreated waste	Waste treatment provided	Adequacy of treatment facilities		Population equivalent discharged to watercourse	Project needs	Current status of municipal action
					Capy.	Char.			
North Platte River									
Michigan River	661.7								
Walden, Colo.	12.0	680	680	Primary	Sat.	Sat.	340	None	-
Encampment River	590.8								
Encampment, Wyo.	10.0	90	90	None	-	-	90	New plant	Inactive
Saratoga, Wyo.	579.2	900	900	Primary	Sat.	Sat.	580	None	-
Sugar Creek	530.0								
Rawlins, Wyo.	14.0	6,000	6,000	None	-	-	6,000	New plant	Inactive
Sinclair, Wyo.	8.[illegible]	850	850	Primary	Unsat.	Sat.	550	Enlarge	Inactive
Medicine Bow River	494.7								
Rock Creek	99.0								
[illegible] Creek	47.0								
Rock River, Wyo.	2.0	380	380	None	-	-	380	New plant	Inactive
Medicine Bow, Wyo.	79.0	450	450	None	-	-	450	New plant	Inactive
Bureau of Reclamation Camp,Mills,Wyo.	399.0	400	400	Primary	Sat.	Sat.	260	None	-
Casper Creek	396.3								
Casper Air Base, Wyo.	8.0	50	50	Lagoon	Sat.	Sat.	0	None	-
Casper, Wyo.	396.0	25,000	25,000	None	-	-	25,000	New plant	Inactive
Glenrock, Wyo.	366.0	1,250	1,250	None	-	-	1,250	New plant	Inactive
Douglas, Wyo.	325.0	2,600	2,600	None	-	-	2,600	New plant	Inactive
[illegible] Creek	250.0								
Sunrise, Wyo.	4.0	330	330	Secondary	Sat.	Sat.	80	None	-
Hartville, Wyo.	4.0	250	250	Secondary	Sat.	Sat.	90	None	-
Guernsey, Wyo.	249.5	700	700	None	-	-	700	New plant	Inactive
Laramie River	232.2								
Laramie, Wyo.	135.0	14,000	14,000	Primary	Unsat.	Unsat.	14,000	Replace	Plans initiated
[illegible] Creek	27.0								
Wheatland, Wyo.	9.0	2,500	2,500	Minor[2]	Unsat.	Unsat.	2,500	Replace	Inactive
Rawhide Creek	217.2								
Lingle, Wyo.	3.0	550	550	None	-	-	550	New plant	Inactive
Torrington, Wyo.	208.5	3,500	3,500	None	-	-	3,500	New plant	Inactive
Henry, Nebr.	199.0	80	310	None	-	-	310[a]	New plant	Inactive
Horse Creek	193.6								
Lyman, Nebr.	5.0	350	350	None	-	-	350	New plant	Inactive
Morrill, Nebr.	191.3	600	840	None	-	-	840	New plant	Inactive
Mitchell, Nebr.	184.7	1,800	2,600	None	-	-	2,600	New plant	Inactive
Scottsbluff, Nebr.	173.8	9,000	16,150	None	-	-	16,150	New plant	Inactive
Gering, Nebr.	173.0	2,000	35,000	Minor[2]	Unsat.	Unsat.	33,000[a]	Replace	Inactive
Minatare, Nebr.	165.5	800	800	None	-	-	800	New plant	Inactive
Melbeta, Nebr.	165.5	80	80	Minor[2]	Unsat.	Unsat.	80	Replace	Inactive
Bayard Canal	149.5								
Bayard, Nebr.	5.0	1,700	1,700	None	-	-	1,700	New plant	Inactive
Bridgeport, Nebr.	141.5	1,000	2,390	None	-	-	2,390	New plant	Inactive
Broadwater, Nebr.	127.0	150	150	None	-	-	150	New plant	Inactive
Lost Creek	95.0								
Oshkosh, Nebr.	1.0	700	1,030	None	-	-	1,030	New plant	Inactive
Lewellen, Nebr.	84.0	300	300	Secondary	Sat.	Sat.	80	None	-
North Platte, Nebr.	5.0	10,100	38,300	None	-	-	38,300[b]	New plant	Inactive
Totals		89,140	160,480				156,700		

[1] Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

[2] Septic tank.

[a] Land application.

[b] An additional 6,900 population equivalent is discharged untreated to the South Platte River.

Table NP-3. North Platte River Sub-Basin - Basic data on sources of industrial pollution - Industries discharging wastes directly to watercourse.

Receiving stream, name and location of industry[1]	River miles from mouth	Type of industry	Type of waste produced	Treatment or other pollution control measures		Population equivalent (B.O.D.) discharged to watercourse	Project needs or equivalent control measures	Current status of industrial action
				Degree	Adequacy			
North Platte River								
Sugar Creek	530							
Sinclair Oil Refinery Sinclair, Wyo.	-	Petroleum	Organic and inorganic	Lagoon	Adequate	(a)	None	-
Standard Oil Refinery Casper, Wyo.	396	Petroleum	Organic and inorganic	Partial[2]	Inadequate	40,000	Enlarge	Inactive
Texaco Oil Refinery Casper, Wyo.	390	Petroleum	Organic and inorganic	Partial[2]	Inadequate	14,000	Enlarge	Inactive
Socony Vacuum Oil Refinery Casper, Wyo.	389	Petroleum	Organic and inorganic	Partial[2]	Inadequate	6,000	Enlarge	Inactive
Continental Oil Refinery Glenrock, Wyo.	366	Petroleum	Organic and inorganic	Partial[2]	Inadequate	6,000	Enlarge	Inactive
Holly Sugar Refinery Torrington, Wyo.	206	Food and kindred products	Organic	None	-	550,000	New plant	Inactive
Platte Valley Poultry Marketing Henry, Nebr.	199	Food and kindred products	Organic	None	-	900	New plant	Inactive
Great Western Sugar Refinery Mitchell, Nebr.	184	Food and kindred products	Organic	None	-	170,000	New plant	Inactive
Co-Op Oil Refinery Scottsbluff, Nebr.	174	Petroleum	Organic and inorganic	Partial[2]	Inadequate	1,200	Enlarge	Inactive
Flicker Packing Co. Scottsbluff, Nebr.	174	Food and kindred products	Organic	None	-	550	New plant	Inactive
Idlewild Dairy Scottsbluff, Nebr.	174	Food and kindred products	Organic	None	-	1,600	New plant	Inactive
Scottsbluff Rendering Plant Scottsbluff, Nebr.	174	Food and kindred products	Organic	None	-	2,200	New plant	Inactive
Baruch Packing Co. Scottsbluff, Nebr.	174	Food and kindred products	Organic	None	-	1,160	New plant	Inactive
R.& B. Packing Co. Scottsbluff, Nebr.	174	Food and kindred products	Organic	None	-	720	New plant	Inactive
Great Western Sugar Refinery Scottsbluff, Nebr.	173	Food and kindred products	Organic	None	-	650,000	New plant	Inactive
Miller Packing Co. Gering, Nebr.	173	Food and kindred products	Organic	None	-	100	New plant	Inactive
Great Western Sugar Refinery Gering, Nebr.	173	Food and kindred products	Organic	None	-	300,000	New plant	Inactive
Union Pacific Roundhouse Gering, Nebr.	173	Transportation equipment	Organic and inorganic	None	-	-	New plant	Inactive
Great Western Sugar Refinery Bayard, Nebr.	150	Food and kindred products	Organic	None	-	170,000	New plant	Inactive
Flicker Packing Co. North Platte, Nebr.	5	Food and kindred products	Organic	None	-	1,020	New plant	Inactive
Sixth Street Market North Platte, Nebr.	5	Food and kindred products	Organic	None	-	1,100	New plant	Inactive
North Platte Stockyards North Platte, Nebr.	5	Food and kindred products	Organic	None	-	420	New plant	Inactive
Totals						1,916,570		

[1] Industries having separate outlets.

[2] Oil-water separation.

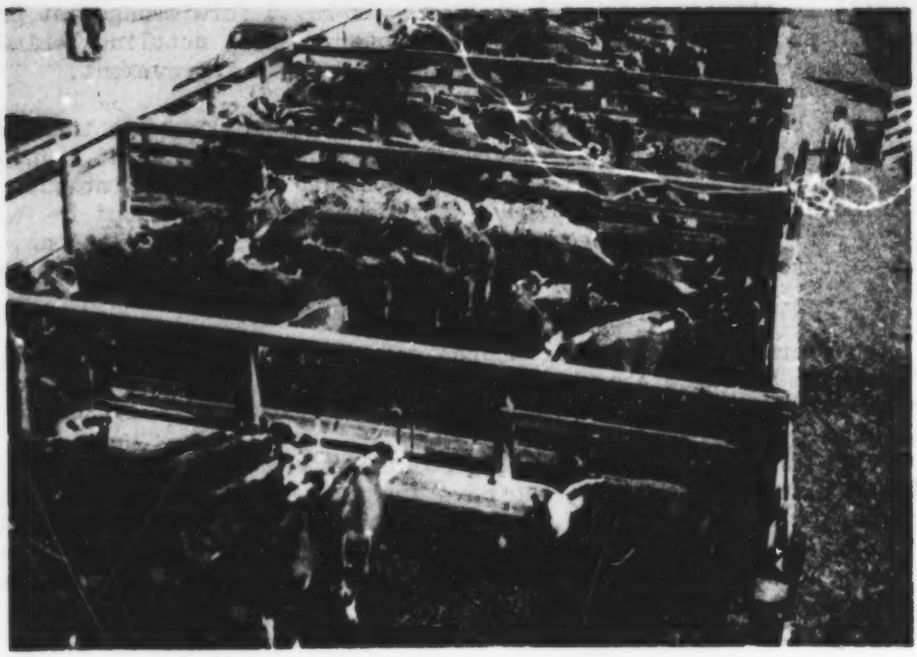
[a] Not discharged to watercourse.

Silt in streams remains a problem. Improved farm management practices hold promise of alleviating this factor. Also, settling behind dams successively clarifies the stream for over-all improvement.

Needs have been established for 21 new municipal sewage treatment plants, 4 replacements, and 1 enlargement to an existing plant. Industry has needs for 16 new plants and enlargements at 5 installations. These needs and the required degree of treatment are tabulated in table 3, Part I. Cost of recommended treatment plant installations, excluding interceptors, maintenance and operation, is conservatively estimated at $15,500,000.

Considerable pollution is discharged in Wyoming to the North Platte River a short distance above the Nebraska State line. The effects of the waste are evident in Nebraska and constitute interstate pollution.

There is need for considerable pollution abatement activity in this Sub-Basin. Nebraska and Colorado have specific need for the enactment of comprehensive water pollution control legislation, as existing laws are inadequate. Wyoming's water pollution control laws appear to be reasonably satisfactory. Lack of State Health Department personnel also has been a serious handicap.



Meat and oil industries are prominent in the Missouri Basin

OSAGE-GASCONADE RIVERS SUB-BASIN

A cooperative State-Federal report on water pollution in the Osage (Marais des Cygnes) - Gasconade Rivers drainage areas was published in March 1952. That report, brought up-to-date as of January 1, 1953, by the State Water Pollution Control Agencies of Missouri and Kansas, forms the basis of this section.

General Description

The Osage (Marais des Cygnes) River rises in east central Kansas, flows in a generally southeasterly direction to a point near Osceola, Missouri, where it bends and continues on a northeasterly course to its confluence with the Missouri River at Osage City, Missouri. The river is 496 miles long and drains an area of 15,300 square miles. Principal tributaries are the Little Osage, Sac, Pomme de Terre, South Grand, and Niangua Rivers.

The Gasconade River has its origin in south central Missouri on the northern slopes of the foothills of the Ozark Mountains, and flows in a northeasterly direction to its junction with the Missouri River at Gasconade, Missouri. The drainage area of the Gasconade River is 3,600 square miles. The Gasconade River is 270 miles long and its principal tributaries are Osage Fork, Roubidoux, Big Piney and Little Piney Creeks.

Population of the Osage-Gasconade Sub-Basin is approximately 425,000. Ottawa, Kansas, with population of 10,051 (1950 census) is the largest city. Other cities with populations larger than 5,000 are Fort Scott, Kansas, and Nevada, Clinton, and Lebanon, Missouri. The cities and towns serve chiefly as marketing and distribution centers for agricultural products of surrounding areas.

The economy is largely supported by agriculture and its related industries. Principal crops are corn, wheat, hay, and forage. Dairy and poultry industries are well established and their produce is marketed principally in St. Louis and Kansas City, Missouri. Hardwood forests supply a valuable source of construction material.

Mineral resources, found primarily in Kansas, are oil, natural gas, and coal. Coal is also strip-mined in the western tier of Missouri counties.

The tourist trade, largely lured by recreational attractions of Lake of the Ozarks, has become a major industry. Lake of the Ozarks was formed by Bagnell Dam, constructed in 1931 by the Union Electric Light and Power Company. In 1950 the Missouri Highway Commission estimated that 950,000 out-of-state visitors per year vacationed at the Lake, and this did not represent more than 50 percent of the total number of vacationers. In addition to the recreational value of the reservoir, large quantities of hydroelectric power are produced.

Water Uses

Water resources of the Osage-Gasconade Sub-Basin are used extensively for domestic water supplies, game fishing, other recreational purposes, support of wildlife, hydroelectric power, limited navigation, and for removal and ultimate disposal of domestic and industrial wastes.

Surface waters serve numerous domestic water supplies. It is estimated that 45,200 people are supplied with 4,790,000 gallons of surface water each day from 19 municipal systems. Forty-six other communities derive 2,720,000 gallons daily for 49,600 people from ground sources, usually by means of deep wells.

Surface water resources have been used relatively little for industrial water supplies or irrigation. Industry located in the area has been of a type which requires very little water in its operations.

Development of the Lake of the Ozarks has resulted in extensive recreational use of water resources. Each year nearly 2,000,000 people enjoy fishing, boating, swimming, and other available water sports. Streams of the Sub-Basin have always supported an extensive sport fishery and this use was enhanced by the development of the large reservoir. The waterways also afford resting place for large flocks of migratory birds and provide an ideal habitat for numerous small game terrestial animals. Available pasture land has been conducive to production of large numbers of livestock whose water supply is obtained principally from streams.

Hydroelectric power is produced at Bagnell Dam, at a smaller dam near Osceola, and at Niangua and Caplinger Mills; total installed capacity is 134,025 kilowatts. Several other sites yet undeveloped have hydroelectric power potentialities. Navigation is limited to small power boats and pleasure craft which operate for a short distance in the main stems of both the Osage and Gasconade Rivers above their respective junctions with the Missouri River, and on Lake of the Ozarks. Streams and creeks of the Sub-Basin are of necessity used quite extensively for removal and ultimate disposal of waste products from industry and populated places.

Low flows appear to be critical in the upper reaches of the Osage River and in small tributaries. Low flow data and probable low monthly mean flows expected to occur once in 2, 3, 5 and 10 year periods are shown in table OG-1. Anticipated low flow expectancies offer a basis for sewage treatment design since disposal plants should provide protection to a stream over a reasonable period of time.

Sources of Pollution

Extensive sewage treatment has been practiced for many years. Sources of municipal and industrial pollution with pertinent data are presented in tables OG-2 and OG-3 and summarized in tables 1 and 2, Part I.

Table 03-1. Osage (Marais des Cygnes) - Gasconade Rivers Sub-Basin - Probable frequency of low mean monthly discharges

Osage (Marais des Cygnes) River

Years of record	Stream and location	Miles to mouth		Drainage area square miles	Minimum monthly mean flows in cubic feet per second that may be expected once in:				Minimum low mean monthly flow of record
		Osage River	Tributary		2 years	3 years	5 years	10 years	
	SUMMER PERIOD (JUNE-SEPT)								
13	Osage River (Marais des Cygnes) Quenemo, Kans.	480		1,030	3	0.9	0.3	0	0
7	Salt Creek Lyndon, Kans.	465	10	111	8	1	0.6	0.4	0
22	Osage River (Marais des Cygnes) Ottawa, Kans.	396		1,250	9.5	3.0	1.8	0.4	0
7	Pottawatomie Creek Garnett, Kans.		37	334	6.5	3.5	1.5	0.7	1.1
18	Osage River (Marais des Cygnes) Trading Post, Kans.	316		2,880	31	8.5	2.5	0.6	0
17	Marmaton River Fort Scott, Kans.		18 28	411	2.5	1.5	0.8	0.35	0.4
22	Sac River Stockton, Mo.	235	40	1,160	138	67	59	39	8.88
20	Osage River Osceola, Mo.	230		8,220	355	186	100	58	7.5
22	Pomme de Terre River Hermitage, Mo.		29	695	29	17.5	11	7	0.18
22	South Grand River Brownington, Mo.	176	38	1,660	13	4.5	1.5	0.5	0
15	Niangua River Decaturville, Mo.	113	14	627	187	166	148	130	107
21	Osage River Bagnell, Mo.		80	14,000	1,380	1,054	795	600	492
15	St. Thomas, Mo.		46	14,750	1,660	1,410	1,150	910	831
	WINTER PERIOD (DEC-FEB)								
13	Osage River (Marais des Cygnes) Quenemo, Kans.	480		1,030	9	3.5	1.5	0.6	1.8
7	Salt Creek Lyndon, Kans.	465	10	111	4	2	1	0.6	0
22	Osage River (Marais des Cygnes) Ottawa, Kans.	396 367		1,250	19	6	2	0.7	0.07
7	Pottawatomie Creek Garnett, Kans.		37	334	26	7.5	2	0.6	0
18	Osage River (Marais des Cygnes) Trading Post, Kans.	316		2,910	105	25	6.5	1.6	0
17	Marmaton River Fort Scott, Kans.		18 28	411	30	15	7.5	3.8	1.0
22	Sac River Stockton, Mo.	235	40	1,160	302	199	138	87	55.8
20	Osage River Osceola, Mo.	230 187		8,220	1,150	550	270	185	78.8
22	Pomme de Terre River Hermitage, Mo.		29	695	148	89	56	35	20.8
22	South Grand River Brownington, Mo.	176	38	1,660	75	24	8.0	2.5	0.38
15	Niangua River Decaturville, Mo.	113	14	627	248	211	186	160	159
21	Osage River Bagnell, Mo.	80		14,000	3,230	2,180	1,580	1,180	506
15	St. Thomas, Mo.	46		14,500	3,160	2,240	1,580	1,100	640

Gasconade River

Years of record	Stream and location	Miles to mouth		Drainage area square miles	Minimum monthly mean flows in cubic feet per second that may be expected once in:				Minimum low mean monthly flow of record
		Gasconade River	Tributary		2 years	3 years	5 years	10 years	
	SUMMER PERIOD (JUNE-SEPT)								
13	Gasconade River Hazelgreen, Mo.	180		1,250	116	110	66	40	31
16	Waynesville, Mo.	136		1,680	184	153	133	87	68
16	Big Piney River Big Piney, Mo.	115	22	560	132	121	103	98	89
13	Little Piney River Newburg, Mo.	108	4	200	43	37	36	22	22
16	Gasconade River Jerome, Mo.	107		2,840	595	513	446	353	326
16	Rich Fountain, Mo.	53		3,180	682	558	504	401	334
	WINTER PERIOD (DEC-FEB)								
13	Gasconade River Hazelgreen, Mo.	180		1,250	247	194	162	144	123
16	Waynesville, Mo.	136		1,680	505	256	255	206	195
16	Big Piney River Big Piney, Mo.	115	22	560	234	191	156	135	127
13	Little Piney River Newburg, Mo.	108	4	200	64	56	45	39	36
16	Gasconade River Jerome, Mo.	107		2,840	1,090	768	630	526	556
16	Rich Fountain, Mo.	53		3,180	1,238	814	722	640	581

Forty-five municipalities and eight separately sewered industries discharge wastes into the Osage-Gasconade watershed. Municipal systems serve 111,980 people and numerous small industries which contribute additional organic wastes with a population equivalent of 19,630. The eight separately discharging industries contribute wastes equivalent in organic content to a population of 5,540.

Sewage treatment installed at 42 municipalities serving 94 percent of the sewered population provides an over-all reduction of 70 percent of the municipal pollution. Three industries have treatment facilities, but these are inadequate. The industrial waste load, discharged in widely separated areas and in relatively small quantities, originates mostly from milk processing, canning, and meat or poultry packing.

Strip mine drainage has affected approximately 170 miles of river reaches in the Osage River watershed of Missouri; some streams contain virtually no aquatic life. Mine wastes reportedly also affect streams in two adjacent Kansas counties.

Sewage and waste treatment needs have been established and are tabulated in table OG-3 and table 3, Part I. Municipal needs are as follows: 3 new plants, 9 replacements and 10 additions or enlargements. Requirements for industry include 5 new plants, 2 replacements and 1 enlargement. Estimated costs for sewage and waste treatment plant construction excluding interceptors, operation and maintenance is $2,000,000.

Interstate pollution has been experienced in the past in the Marmaton River below Fort Scott, Kansas. A new sewage plant with a high degree of treatment now in operation at Fort Scott affects sufficient treatment to alleviate interstate pollution, yet additional treatment is needed. All Kansas sewered municipalities of the Sub-Basin provide treatment; all but one have secondary treatment.

Legal authority of the Water Pollution Control Agency of the State of Missouri should be broadened in scope by legislative action to facilitate execution of the comprehensive water pollution control program. However, the record indicates excellent progress in securing pollution abatement by the Health Departments of both Kansas and Missouri.

Table [illegible]-2. Osage (Marais des Cygnes)-Gasconade Rivers Sub-Basin - Basic data on sources of municipal pollution.

Receiving stream, name and location of municipality[1]	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) untreated waste	Waste treatment provided	Adequacy of treatment facilities		Population equivalent discharged to watercourse	Project needs	Current status of municipal action
					Cap.	Eff.			
Missouri River	129.0								
Osage River									
Quenemo, Kans.	427.7	400	400	Secondary	Sat.	Unsat.	200	None	-
Salt Creek	427.7								
Osage City, Kans.	25.0	1,400	1,400	Secondary	Sat.	Sat.	350	None	-
Lyndon, Kans.	12.6	600	600	Secondary	Unsat.	Unsat.	300	Replace	Inactive
Dragoon Creek	427.0								
Burlingame, Kans.	30.0	950	950	Secondary	Sat.	Sat.	300	None	-
Ottawa, Kans.	398.0	10,000	10,000	Secondary	Sat.	Sat.	1,500	None	-
[illegible] Creek	370.0								
[illegible], Kans.	25.0	1,200	1,200	Secondary	Sat.	Sat.	130	None	-
Osawatomie-State Hospital, Kans.	369.0	2,000	2,800	Secondary	Sat.	Sat.	300	None	-
Pottawatomie Creek	367.4								
Garnett, Kans.	45.0	2,000	2,000	Secondary	Unsat.	Sat.	300	Enlarge	Inactive
Osawatomie, Kans.	1.0	3,800	3,800	Secondary	Sat.	Unsat.	1,100	None	-
Big Bull Creek	360.3								
Gardner, Kans.	35.0	(a)	(a)	Secondary[a]	Sat.	Sat.	(a)	None	-
[illegible] Creek	25.0								
[illegible]ville, Kans.	10.0	400	500	Secondary	Sat.	Sat.	150	None	-
Paola, Kans.	6.6	3,200	3,200	Secondary	Unsat.	Unsat.	1,300	Enlarge	Inactive
LaCygne, Kansas	332.1	700	700	Primary	Unsat.	Unsat.	300	Addition	Inactive
[illegible] Creek	305.0								
Pleasanton, Kans.	15.0	1,000	1,000	Secondary	Unsat.	Unsat.	300	Replace	Inactive
[illegible] Creek	282.0								
[illegible]	6.0								
Butler, Mo.	5.0	2,250	1,000	Secondary	Unsat.	Sat.	1,000	Enlarge	Inactive
Little Osage River	273.5								
Marmaton River	18.2								
[illegible], Kans.	60.0	(a)	(a)	Secondary[a]	Sat.	Sat.	(a)	None	-
Fort Scott, Kans.	38.2	10,000	11,000	Secondary	Unsat.	Sat.	3,000	Addition	Inactive
Nevada, Mo.	15.0	3,000	3,000	None	-	-	3,000	New plant[b]	Final plans approved
Nevada-State Hospital #3, Mo.	14.0	2,400	2,400	None	-	-	2,400	New plant[b]	Final plans approved
Clear Creek	253.9								
[illegible]	10.0								
El Dorado Springs, Mo.	3.0	1,200	2,790	None	-	-	2,100	New plant	Final plans approved
Sac River	235.3								
[illegible] Creek	55.0								
Greenfield, Mo.	12.0	700	1,030	Primary[c]	Unsat.	Sat.	750	Addition[c]	Inactive[c]
Little Sac River	45.0								
Springfield (N.W.Plant), Mo.	5[illegible].0	8,000	8,000	Secondary	Sat.	Sat.	800	None	-
[illegible]	38.0								
Stockton, Mo.	2.5	30	30	Minor[d]	Unsat.	Sat.	20	Replace	Inactive
Osceola, Mo.	230.9	460	460	Minor[d]	Unsat.	Unsat.	380	Replace	Inactive
Pomme de Terre River	187.2								
[illegible]	65.0								
Bolivar, Mo.	5.0	2,000	6,000	Secondary	Unsat.	Sat.	2,640	Enlarge	Final plans approved
South Grand River	175.6								
[illegible]	110.0								
[illegible]	5.0								
[illegible], Mo.	17.0	1,000	1,300	Secondary	Unsat.	Sat.	300	Enlarge	Inactive
[illegible]	95.0								
Harrisonville, Mo.	15.0	1,950	1,950	Primary	Unsat.	Sat.	1,250	Replace	Inactive
Big Creek	53.0								
Pleasant Hill, Mo.	60.0	1,450	1,600	Minor[d]	Unsat.	Sat.	1,130	Replace	Inactive
Clinton, Mo.	45.0	4,950	5,850	Primary	Unsat.	Sat.	3,300	Enlarge	Planning initiated
[illegible] Creek	38.0								
[illegible], Mo.	3.0	450	450	Secondary	Sat.	Sat.	40	None	-
Tebo Creek	3.0								
[illegible] Creek	13.0								
[illegible] Creek	8.0								
Windsor (N.E.Plant), Mo.	11.0	300	800	Secondary	Sat.	Sat.	200	None	-
Windsor (S.W.Plant), Mo.	10.0	1,900	2,370	Secondary	Sat.	Sat.	310	None	-
Warsaw, Mo.	173.3	790	1,080	Minor[d]	Unsat.	Unsat.	610	Replace	Inactive
Cole Camp Creek	171.0								
Cole Camp, Mo.	22.0	480	480	Secondary	Sat.	Sat.	60	None	-
Niangua River	112.8								
Marshfield, Mo.	110.0	1,400	3,200	Secondary	Sat.	Sat.	400	None	-
Camdenton (S.Plant), Mo.	5.0	100	100	Minor[d]	Unsat.	Unsat.	80	Replace[e]	Final plans approved
Linn Creek	108.0								
Camdenton (N.Plant), Mo.	5.0	100	100	Minor[d]	Unsat.	Unsat.	80	Replace[e]	Final plans approved
Linn Creek, Mo.	3.0	110	110	Secondary	Sat.	Sat.	25	None	-
Grand Glaize Creek	100.5								
[illegible] Creek	5.0								
[illegible], Mo.	45.0	4,160	7,910	Secondary[c]	Sat.	Sat.	1,460	None	-
Lakeside, Mo.	81.0	120	120	Minor[d]	Sat.	Sat.	100	None	-
[illegible] Creek	50.0								
[illegible], Mo.	50.0	250	250	Secondary	Sat.	Sat.	30	None	-
[illegible] Creek	9.9								
[illegible], Mo.	60.0	1,100	1,100	Secondary	Sat.	Sat.	200	None	-
Gasconade River	120.0								
[illegible] Creek	245.0								
Mountain Grove, Mo.	25.0	1,500	3,400	Secondary	Sat.	Unsat.	850	None	-
Roubidoux Creek	142.0								
Waynesville, Mo.	3.0	910	910	Secondary	Sat.	Sat.	90	None	-
Big Piney Creek	115.0								
Cabool, Mo.	80.0	800	2,600	Secondary	Sat.	Sat.	450	None	-
Houston, Mo.	59.0	400	400	Secondary	Sat.	Sat.	50	None	-
Ft. Leonard Wood	7.0	30,000[f]	30,000[f]	Secondary	Sat.	Sat.	4,500[f]	None	-
Totals		111,980	131,610				39,440		

[1] Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

[a] New system and treatment plant, no further data available.

[b] Plans approved to treat waste from Nevada and State Hospital #3 in one plant.

[c] Two treatment plants.

[d] Septic tank.

[e] Camdenton, whose population greatly exceeds the population served by existing treatment, has plans approved to replace the two existing septic tanks with one treatment plant.

[f] Population fluctuates.

Table VI-5. [illegible] - [illegible] - Basic data on sources of industrial pollution.

Receiving stream, name and location of industry¹	River miles from mouth	Type of industry	Type of waste produced	Treatment or other pollution control measures		Population equivalent (B.O.D.) discharged to watercourse	Project needs or equivalent control measures	Current status of industrial action
				Degree	Adequacy			
[illegible]	143.0							
[illegible]	139.1							
[illegible]	15.0							
[illegible] [illegible], Mo.	2.5	Food and kindred products	Organic	None	-	1,800	New plant	Inactive
[illegible]	10.0							
[illegible] [illegible], Mo.	20.0	Food and kindred products	Organic	Minor	Inadequate	600	Replace	Inactive
[illegible] [illegible], Mo.	270.0	Food and kindred products	Organic	None	-	140	New plant	Inactive
[illegible] [illegible], Mo.	291.9	Food and kindred products	Organic	None	-	1,400	New plant	Inactive
[illegible]	107.2							
[illegible]	15.0							
[illegible]	20.0							
[illegible] [illegible], Mo.	2.0	Food and kindred products	Organic	None	-	240	New plant	Inactive
[illegible]	112.0							
[illegible] [illegible], Mo.	71.0	Food and kindred products	Organic	None	-	750	New plant	Final plans approved
[illegible]	110.0							
[illegible]	100.0							
[illegible] Co. [illegible], Mo.	15.0	Food and kindred products	Organic	Partial	Inadequate	600	Replace	Inactive
[illegible] [illegible], Mo.	231.0	Food and kindred products	Organic	Partial	Inadequate	300	Enlarge	Inactive
Total						5,300		

¹Industries having separate outlets.

SOUTH PLATTE RIVER SUB-BASIN

This section is based upon the "South Platte River Drainage Basin - A Cooperative State-Federal Report on Water Pollution" published February 1953. The data are current as of January 1, 1953, as reported by the respective State Health Departments of Colorado, Nebraska, and Wyoming.

General Description

The South Platte River Sub-Basin encompasses 24,030 square miles, of which 19,022 are in Colorado, 3,011 in Nebraska, and 1,997 in Wyoming. The South Platte River rises along the eastern front range of the Rocky Mountains in central Colorado and flows northeasterly some 440 miles to join the North Platte River at North Platte, Nebraska. All but about 60 miles of the main stem is within the State of Colorado. The South Platte River is a shallow, swiftly flowing, relatively small stream. It has a mean annual discharge of 500 second-feet; however, periods of no flow exist in reaches below points where water is diverted during maximum water use,or during drought.

The climate, generally semiarid, is largely influenced by topographic characteristics. The greatest precipitation occurs in the mountains. Approximately one-fourth of the region lies above 8,000 feet mean sea level; one-fourth is between 6,000 and 8,000 feet m.s.l.; and the remainder between 3,000 and 6,000 feet m.s.l.

In 1950 the population of the Sub-Basin was 840,000, of which 90 percent lived in Colorado, 5 percent in Nebraska, and 5 percent in Wyoming. Approximately 70 percent of the population is classified as urban. Denver, Colorado, the largest city, had a 1950 population of 415,786.

The economy is supported by agriculture, a large resort and tourist business, and a variety of industries. Most crops are raised on irrigated land and include hay, forage, sugar beets, potatoes, barley, beans, corn, oats, rye, sorghums and wheat. Large numbers of livestock are produced. Truck farming, particularly in the vicinity of Denver, is important. Much of the industry is closely allied with agriculture. Large quantities of sugar beets, fruits, vegetables, milk, meat, poultry and grains are processed.

Mining is an extensive operation, ranking third in value of production. Coal, gold, silver, copper, lead and zinc are obtained in considerable amounts. Coal has become lately the most valuable mining product. Oil production has been a very valuable industry and recent discoveries of oil in the vicinity of Sterling, Colorado, and Sidney, Nebraska, have resulted in a rapid growth of the industry in northeastern Colorado and southwestern Nebraska.

Water use continues to be a major factor in the Sub-Basin development and, unless more efficient use is made of existing water resources or additional water is secured, further economic expansion will come slowly. Water resources have been overappropriated and it is seldom that all water rights can be met. Two transmountain diversions, the proposed Blue-South Platte and the Colorado-Big Thompson now essentially completed, will add approximately 690,000 acre-feet annually to the Sub-Basin's water supply.

Water Uses

An estimated 2,800,000 acre-feet of water per year are supplied from surface and ground sources for domestic and industrial supplies, and irrigation. These waters also serve for watering of livestock, fishing, other recreational purposes, development of hydroelectric power, and the removal and ultimate disposal of municipal and industrial wastes. Water contributes much to the natural scenery of the region, and is used extensively for almost all purposes except navigation.

Provision for an adequate domestic and industrial surface water supply to serve 137.89 M.G.D. to about 633,100 people residing in 28 communities has been a major problem. Approximately 75 percent of the domestic water consumers are supplied through the Denver public system. At the present time about 30 percent of the Denver supply is obtained by transmountain diversion via the Moffat Tunnel. The remainder is taken from the South Platte River and from Cherry and Bear Creeks. Twenty-seven other communities located in mountainous regions or within a short distance of mountain streams, with an aggregate population of about 152,000, also obtain their water supply from streams or surface impoundments. No public water supplies are taken directly from streams in the plains regions, probably because streams have unreliable flows, contain excessive concentrations of minerals, or are highly polluted. Surface water supplies for the most part are obtained from mountain streams not subject to excessive pollution. Municipalities of the South Platte Sub-Basin use about 258,000 acre-feet of water annually with about 225,000 acre-feet of it derived from surface sources and the remainder from ground supplies. Forty-nine municipalities obtain their supplies from wells and serve over 61,400 people with 12.10 million gallons per day.

Because of the difficulty of obtaining adequate private water supplies industries usually are served by municipal systems. However, some of the major industrial water users, such as sugar refineries, have their own wells or pump water from streams and irrigation ditches. The water requirements of industry not connected to municipal systems are estimated at 50,000 acre-feet annually.

Irrigation requires the greatest volume of water. It has been estimated that 1,405,000 acres were under irrigation in 1944, when 2,087,000 acre-feet of water was used. Undoubtedly, more water would have been utilized had it been available. This acreage has not been materially increased. It is anticipated that when completed the Colorado-Big Thompson transmountain diversion will supply approximately 260,000 additional acre-feet of water for irrigation and other purposes below Platteville, Colorado. If the Blue-South Platte project is constructed an additional 430,000 acre-feet annually, diverted from the western slope, will become available for use in the area from the North Fork of the South Platte to Fort Lupton, Colorado, and will add about 49,000 acre-feet annually to the Denver municipal supply.

Water resources of the region have great recreational potential. It is estimated that the tourist trade gross business value was nearly $200,000,000 in the State of Colorado in 1949, of which a goodly portion is credited to that section of Colorado within the South Platte drainage area. In their natural state, headwater streams support an excellent fishery. Excessive sport fishing, together with pollution, has resulted in considerable depletion of fishery resources. To counteract these conditions, the Colorado Game and Fish Department has established fish hatcheries to periodically restock streams with game fish. The most popular fishing spots are to be found in the headwaters of the Cache la Poudre and Thompson Rivers; the St. Vrain, Boulder, and Bear Creeks; and in the South Platte River and its tributaries above Watertown. Clear Creek, according to historical records, provided an excellent fish habitat prior to the extensive mining developments along its banks. Pollution resulting from ore processing operations is now being confined; however, in the earlier days there was little control of the disposal of mine tailings and processing wastes, and profound, prolonged changes occured in the character of the stream beds.

Water resources for recreational use have been enhanced by construction of a number of reservoirs in or adjacent to the Rocky Mountain National Park, particularly the Granby, Shadow Mountain, Mary's Lake, Estes, and Horsetooth impoundments. The recreational potential for fishing, boating, and tourist use of some of the impoundments is great.

Production of hydroelectric power is an important use of water; power plants are located on South Clear Creek, Clear Creek, Byer Creek, Fall River, Middle Boulder Creek, Boulder Creek, North St. Vrain Creek, Big Thompson River, and on a number of very small streams. Total installed hydroelectric capacity of the Sub-Basin is estimated at 78,270 kilowatts.

Waterways of the region also serve to supply the needs of wildlife, including large and small game. A considerable number of ducks and geese use the waterways as resting places during their migratory flights.

Streams in mountain sections are perennial and swift flowing; those beginning in the high plains are intermittent. The natural flow characteristics of the streams have been altered by diversions for appropriated water rights. Most streams in this area have been overappropriated. The South Platte River may be completely diverted for irrigation and other uses at many locations. Stream flow data for the South Platte and various tributaries are presented in table SP-1.

Sources of Pollution

Pollution of Sub-Basin streams results from organic and inorganic wastes including silt. Communities contribute a large and increasing segment of the pollutional load.

The population served by 73 municipal sewage systems is estimated at 714,500. Industrial plants connected to municipal sewers raise the combined municipal load in population equivalents to 898,900. Fifty-eight communities serving 96 percent of the sewered population have treatment facilities that reduce municipal pollution 46 percent. These data are

Table SP-1. South Platte River Sub-Basin - Summary of published stream flow data for the South Platte River and Tributaries

Stream	Station	Mileage	Drainage Area sq.mi.	Maximum Peak Discharge Sec.-ft.	Maximum Peak Discharge date	Minimum Mean Daily Discharge second-feet	Annual Runoff maximum acre-feet	Annual Runoff minimum acre-feet	Annual Runoff mean acre-feet
South Platte River	Near L. George	384.0	929	990	8-15-30	8.0	108,000	10,270	62,630
	Lake Cheesman	361.5	1,730	3,030	4-23-42	6.5	242,300	35,300	126,940
	Waterton	327.4	2,611	5,700	4-23-42	0.1	513,900	41,530	134,010
	Denver	302.3	3,840	22,000	9-10-33	15.0	801,600	103,900	266,600
	Henderson	286.7	4,792	10,700	4-26-42	6.0	844,000	115,300	242,970
	Ft. Lupton	272.2	5,108	9,000	4-26-42	10.0	877,500	113,100	251,380
	Kersey	231.9	9,500	31,000	6- 7-21	35.0	1,435,000	181,470	560,650
	Sublette	210.0	12,269	30,000*	6- 7-21	--	420,200	93,840	231,060
	Balzac	164.1	17,194	**	5-31-35	4.6	1,030,000	69,000	278,260
	Julesburg	90.2	22,800	31,300	6- 2-35	0.0	1,092,000	61,790	323,700
	N. Platte,Nebr.	0.0	24,030	37,100	6- 3-35	0.0	1,055,000	56,360	377,530
Bear Creek	Morrison,Colo.	11.5	165	8,600	7-24-96	0.8	90,560	13,640	43,580
	Mouth	0.75	265	3,000	7- 7-33	0.7	98,490	5,440	27,820
Clear Creek	Golden, Colo.	18.0	414	8,700	8- 1-88	18.0	278,800	109,900	176,260
	Mouth	0.8	600	3,650	9- 3-38	0.9	118,450	20,900	60,770
St. Vrain Cr.	Lyons, Colo.	36.6	266	10,500	6-22-41	0.0	145,200	51,500	96,490
	Mouth	2.7	1,000	11,300	9- 3-38	12.0	343,770	40,000	130,310
Boulder Cr.	Orodell, Colo.	27.7	105	2,500	6- 6-21	1.5	100,700	37,300	57,700
	Mouth	0.0	485	4,410	9- 3-38	0.0	149,420	3,230	40,420
Big Thompson River	Canon mouth near Drake	39.7	308	5,600	9- 1-38	7.0	150,230	83,350	128,750
	Mouth	0.2	842	3,000	9- 3-38	0.0	48,440	12,560	34,890
Cache la Poudre River	Canon mouth	59.4	1,048	**	5-20-04	3.0	381,400	135,200	303,450
	Mouth	1.1	1,840	4,240	6-24-17	2.3	100,400	20,270	68,300

*Approximate
**Not determined

tabulated in table SP-2.

Industry contributes the largest part of the Sub-Basin's total waste. Table SP-3 contains basic data on 86 sources of pollution originating in industries; 4,191,000 population equivalents are discharged directly to streams during certain times of the year. Fifty-one establishments provide treatment of which 23 are reported to be adequate. There are 12 beet sugar factories of which 11, during the late fall and winter seasonal campaign, contribute an estimated 4,110,000 population equivalents. Expansion of present oil refinery capacities, now in progress, will increase substantially the waste presently discharged to streams by this industry. If oil fields start discharging a brine high in sodium salts, it would seriously affect some present and proposed irrigation developments.

Much of the silt which reaches the waterways can not reasonably be avoided. Mountain torrents cascading over rocky stream beds erode material which is carried by the flowing waters. However, other sources of silt resulting from mining, ore processing, potato washing and, to some extent, poor land management practices, can be controlled. It is necessary to evaluate further the effect of wastes from coal mining, placer gold dredging, and ore processing mills. Present stream pollution results from the disposal of wastes which contain in solution objectionable chemicals as carbonates, chlorides, sulphates; suspended powdered inorganic constituents of the processed ores; and silt from dredging operations. Other objectionable materials discharged include copper, iron, lead, and acid drainage.

The use of sewage and waste-laden waters for irrigation of truck gardens and other farm crops has been noted by public health authorities. The irrigation of low growing fruits and vegetables, especially those commonly consumed without cooking, is of particular significance. Studies indicate that vegetables irrigated with polluted waters carry greater concentrations of bacteria of the intestinal groups than do vegetables irrigated with nonpolluted waters. Transmission, by this means, of enteric parasites such as tapeworms is well recognized, particularly in cattle pastured on lands irrigated with contaminated water.

There is need for 15 new municipal plants, 26 enlargements or additions, and 3 replacements. Twenty-nine new plants, 13 replacements and 15 additions should be effected at industrial plants with separate outlets. Table 3, Part I, lists the names of municipalities and industries where treatment is needed and the recommended degree of treatment. Disinfection of sewage treatment plant effluents is recommended for control of bacterial pollution to protect downstream water supplies and to reduce possible contamination of food crops during the irrigation period. Construction costs of the recommended projects are estimated at $19,500,000. Trunk sewers, pumping stations, chlorination equipment, maintenance and operation costs are not included in these figures.

Municipalities of the Sub-Basin have made considerable effort toward control of their wastes. However, many communities and numerous industries discharge untreated or inadequately treated wastes. Interstate pollution exists below Ovid, Colorado, and extends into Nebraska.

Table SP-1. South Platte River Sub-Basin - Basic data on sources of municipal pollution

Receiving stream, name, and location of municipality[1][n]	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) of untreated wastes	Waste treatment provided	Adequacy of treatment facilities		Population equivalent discharged to watercourse	Project needs	Current status of municipal action
					Now	Ult.			
South Platte River									
Plum Creek	320.0								
Castle Rock, Colo.	28.5	720	720	Lagoon	Unsat.	Unsat.	(a)	Replace	Inactive
Louviers, Colo.	21.0	350	350	Secondary	Sat.	Sat.	180	None	
S.D. #51 (Littleton)	314.0	6,800	6,800	Secondary	Unsat.	Sat.	3,000	Enlarge and add'l treatment	Inactive
S.D. #35 (S. Englewood)	312.0	-	-	(b)	-	-	-		-
Bear Creek	311.5								
Fed. Correctional Inst., Colo.	8.5	900	900	Secondary	Unsat.	Sat.	450	Additional treatment	Inactive
Ft. Logan, Colo.	2.0	3,000	3,000	Secondary	Sat.	Sat.	300	None	-
Loretto Heights College, Colo.	1.0	400	400	Primary	Unsat.	Unsat.	280	Additional treatment	Inactive
Denver, Colo.	299.2	415,000	631,000	Primary(c)	Sat.	Sat.	341,900	Additional treatment	Under construction
S.D. #5 (Mt. View)		900							
S.D. #6 (Columbine Gardens)		600							
S.D. #7 (Edgewater)		3,000							
S.D. #8 (N. Jefferson)		1,800							
S.D. #9 (N. Jefferson Assoc.)		800							
S.D. #10 (N. Lakewood)		750							
S.D. #11 (Alameda)		750							
S.D. #12 (N. Alameda)		800							
S.D. #13 (Ryland Park)		750							
S.D. #14 (Lakewood)		10,700							
S.D. #15 (W. Lakewood)		900							
S.D. #16 (S. Lakewood)		1,800							
S.D. #17 (Englewood)		16,000[b]							
S.D. #18 (E. Washington)		1,800							
S.D. #20 (Hoffman Heights)		2,700							
		457,300							
Sand Creek	297.0								
Toll Gate Creek	8.0								
Buckley Field, Colo.	6.6	1,900	1,900	Secondary	Sat.	Sat.	190	(z)	Inactive
S.D. #30 (Tollgate)	3.0	250	250	None			250	New plant	Preliminary plans
Fitzsimmons Hospital, Colo.	1.8	5,000	5,000	Secondary	Sat.	Sat.	250	None	-
S.D. #27 (Aurora)	5.8	17,000	17,000	Primary	Unsat.	Unsat.	11,900	Replace	Under construction
East Denver Plant, Colo.	3.4	25,000	25,000	Secondary	Unsat.	Sat.	17,500	Additional treatment	Inactive
Clear Creek	290.0								
Georgetown, Colo.	51.0	340	340	None	-	-	340	New plant	Inactive
Idaho Springs, Colo.	37.0	1,800	1,800	None	-	-	1,800	New plant	Inactive
S.D. #37 (Golden)	18.0	6,300	6,300	None		-	6,300	New plant	(d)
S.D. #38 (Prospect Valley)		(1,800)[e]	-	-	-	-	-	-	-
S.D. # 4 (Wheatridge)	3.0	2,300	2,300	Secondary	Sat.	Sat.	600	Additional treatment	Inactive
S.D. # 5 (Fruitdale)		1,000	1,000	None	-	-	1,000	New plant	Under construction
S.D. # 2 (Clear Creek)		3,000	3,000	None	-	-	3,000	New plant	Under construction
Ralston Creek	7.0								
S.D. #1 (Arvada)	1.0	2,400	4,280	Primary	Unsat.	Unsat.	2,800	Add'l treatment	Under construction
S.D. #32 (Baker)		2,000	2,000	Primary	Sat.	Sat.	1,300	Additional treatment	Inactive
Intermittent Stream									
S.D. #33 (Westminster)		3,300	3,300	Secondary	Unsat.	Unsat.	1,500	Add'l treatment	Preliminary plans
S.D. #34 (Brighton)	304.0	4,800	7,000	Secondary	Unsat.	Sat.	4,800	Additional treatment	Inactive
Fort Lupton, Colo.	272.0	2,200	6,400	Primary	Unsat.	Sat.	3,800	Additional treatment	Inactive
Platteville, Colo.	264.4	700	700	None	-	-	700	New plant	Inactive
St. Vrain Creek	253.0								
Lyons, Colo.	37.0	1,480	1,480	None	-	-	1,480	New plant	Under construction(f)
Longmont, Colo.	22.5	8,000	8,000	Secondary	Unsat.	Sat.	4,000	Additional treatment	Inactive
Boulder Creek	20.0								
Boulder, Colo.	13.6	31,400	31,400	Primary	Unsat.	Unsat.	16,000	Enlarge and add'l treatment	Plans approved
Coal Creek	7.0								
Lafayette, Colo.	5.0	1,280	1,280	Primary	Unsat.	Unsat.	880	Add'l treatment	Under construction
Big Thompson River	245.0								
Bureau of Reclamation Camp, Colo.	64.5	800	800	Secondary	Unsat.	Sat.	220	Additional treatment	Inactive
Estes Park, Colo.	58.3	6,000[g]	6,000	Secondary	Unsat.	Sat.	2,400	Additional treatment	Inactive
Loveland, Colo., Plant #1	22.9	3,000	3,000	Secondary	Unsat.	Unsat.	1,000	Additional treatment	Inactive
Plant #2	22.7	6,000	9,780[h]	Secondary	Unsat.	Sat.	5,000	Additional treatment	Inactive
Little Thompson River	5.5								
Berthoud, Colo.	12.8	1,000	1,000	Secondary	Unsat.	Unsat.	400	Additional treatment	Inactive
Johnstown, Colo.	3.0	900	1,380	None	-	-	1,380	New plant	Inactive
Milliken, Colo.	5.5	800	800	None	-	-	800	New plant	Inactive
La Salle, Colo.	238.0	800	800	Septic tank	Unsat.	Unsat.	700	Replace	Inactive
Cache la Poudre River	236								
[illegible], Colo.	-	550	550	Primary	Unsat.	Unsat.	440	Additional treatment	Inactive
Ft. Collins, Colo.	37.6	18,000	18,230	Secondary	Sat.	Sat.	5,400	(z)	Inactive
Windsor, Colo.	21.4	2,000	2,000	Secondary	Unsat.	Sat.	800	Additional treatment	Inactive
Tributary	7.0								
Eaton, Colo.	7.0	1,300	1,300	Septic tank	Unsat.	Sat.	1,000	Additional treatment	Inactive
Greeley, Colo.	4.4	31,000	36,180	Primary	Unsat.	Sat.	18,000	Additional treatment	Inactive
Kersey, Colo.	231.0	250	250	Lagoon	Sat.	Sat.	(a)	None	-
Crow Creek	227.0								
Cheyenne, Wyo.	76.0	38,000	18,000[i]	Secondary	Sat.	Sat.	6,000	None	-
Bijou Creek	188.5								
Deer Trail, Colo.	65.0	290	290	None	-	-	290	New plant	Inactive
Ft. Morgan, Colo.	184.8	3,800	3,700	Lagoon	Unsat.	Unsat.	(a)	None	-
Brush, Colo.	173.8	2,800	2,800	Primary	Unsat.	Unsat.	2,200	Additional treatment	Inactive
Merino, Colo.	168.8	300	300	None	-	-	300	New plant	Inactive
Sterling, Colo.	153.0	7,800	7,000	Primary	Unsat.	Sat.	5,600	Additional treatment	Inactive
Crook, Colo.	122.0	290	290	Primary	Sat.	Sat.	180	None	-
Lodgepole Creek	90.0								
Albin, Wyo.	-	300	300	Lagoon	Sat.	Sat.	(a)	None	-
Pine Bluffs, Wyo.	121.0	800	800	Lagoon	Sat.	Sat.	(a)	None	-
Kimball, Nebr.	101.0	3,000	3,000	Secondary	Unsat.	Unsat.	600	(z)	Inactive
Sidney, Nebr.	66.7	5,000	5,000	Secondary	Sat.	Sat.	1,000	(z)	Inactive
Chappell, Nebr.	12.0	1,300	1,300	Secondary(j)	Unsat.	Sat.	600	Add'l treatment	Under construction
Ovid, Colo.	0.8	650	650	None	-	-	650	New plant	Inactive
Julesburg, Colo.	90.0	1,800	1,800	None	-	-	1,800	New plant	Inactive
Ogallala, Nebr.	57.2	3,000	3,000	Secondary(k)	Sat.	Unsat.	3,000	(z)	Inactive
North Platte, Nebr.	5.0	6,900	6,900	None	-	-	6,900[m]	New plant	Inactive
Totals		714,500	696,580				[m]467,210		

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[1] All sources of pollution listed as "S.D." are Sanitation Districts located in Colorado.

[z] Disinfection recommended for effluents of four existing secondary treatment plants now in operation and the Ogallala treatment plant which requires reactivation.

[a] Does not discharge to stream; effluent to lagoon.

[b] Englewood is constructing a new secondary treatment plant which will also treat wastes from South Englewood.

[c] Denver has an intermediate treatment plant which reduces B.O.D. by about 45%.

[d] New plant under construction which will treat Coors industrial wastes and municipal wastes from Golden.

[e] Sanitation district being organized.

[f] Lyons is constructing a new primary treatment plant. Protection of downstream water uses indicates that secondary treatment and efficient chlorination are necessary.

[g] This figure represents the population served during the summer tourist season. During winter season the 800 permanent residents are served by the primary portion of the treatment plant which effects a 30 percent reduction in B.O.D.

[h] Increase of 3,780 P.E. due to seasonal cannery waste discharging to municipal sewerage.

[i] Includes Ft. Warren.

[j] Secondary plant; however sand filters are being by-passed.

[k] Plant not in operation.

[m] An additional 30,300 population equivalents discharged untreated to the North Platte River.

[n] Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

Table SP-3. South Platte River Sub-Basin - Basic data on sources of industrial pollution - Industries discharging wastes directly to watercourses

Receiving stream, name and location of industry[1]	River miles from mouth	Type of industry	Type of waste produced	Treatment or other pollution control measures Type	 Adequacy	Population equivalent (B.O.D.) discharged to watercourse	Project needs or equivalent control measures	Current status of industrial action
South Platte River								
South Platte Dredging Co. Fairplay, Colo.	435.0	Metal mining	Inorganic	Lagoon	Inadequate	Not applicable	Replace	Inactive
Plum Creek	380.9							
Dupont Nemours Co., Inc. Louviers, Colo.	20.0	Fabricated metal products	Inorganic	None	-	Not applicable	New plant	Inactive
Big Dry Creek	312.5							
Brookridge Farms Dairy Near Denver, Colo.	3.0	Food and kindred products	Organic	Minor	Inadequate	980	Replace	Inactive
[illegible] Creek	303.0							
City Park Farm Dairy Near Denver, Colo.	1.0	Food and kindred products	Organic	None	-	350	New plant	Inactive
Burlington O'Brien Canal	302.0							
Continental Oil Co. Near Denver, Colo.	1.6	Petroleum products	Organic and inorganic	Minor	Inadequate	4,600	Addition	Inactive
Central Fibres Products Co. Near Denver, Colo.	1.2	Paper products	Organic and inorganic	None	-	7,750	New plant	Inactive
C.B.&Q. R.R. Shop Denver, Colo.	298.6	Transportation equipment	Organic and inorganic	Minor	Inadequate	-	Replace	Planning initiated
Colo. & Southern R.R. Shop Denver, Colo.	298.6	Transportation equipment	Organic and inorganic	Minor	Inadequate	-	Replace	Inactive
Rio Grande R.R. Shop Denver, Colo.	298.6	Transportation equipment	Organic and inorganic	Minor	Inadequate	-	Replace	Planning initiated
Santa Fe R.R. Shop Denver, Colo.	298.6	Transportation equipment	Organic and inorganic	Minor	Inadequate	-	Replace	Inactive
Great Western Mushroom Co. Denver, Colo.	-	Food and kindred products	Organic	Lagoon	Adequate	(a)	None	-
Rocky Mountain Arsenal Denver, Colo.	-	Fabricated metal products	Inorganic	Lagoon	Adequate	Not applicable	None	-
Altberger Packing Co. Near Denver, Colo.	297.5	Food and kindred products	Organic	Minor	Inadequate	1,860	Replace	Inactive
National Food Stores, Inc. Near Denver, Colo.	297.5	Food and kindred products	Organic	Minor	Inadequate	4,800	Replace	Inactive
Litvak Meat Co. Near Denver, Colo.	297.5	Food and kindred products	Organic	Minor	Inadequate	3,330	Replace	Inactive
Sanott Packing Co. Near Denver, Colo.	297.5	Food and kindred products	Organic	None	-	600	New plant	Inactive
Dorffler Horse Packing Co. Near Denver, Colo.	297.5	Food and kindred products	Organic	Minor	Inadequate	740	Replace	Inactive
Capitol Rendering Co. Near Denver, Colo.	297.5	Food and kindred products	Organic	Minor	Inadequate	750	Replace	Inactive
Sand Creek	297.0							
Gordon Farms Dairy Near Denver, Colo.	1.0	Food and kindred products	Organic	None	-	750	New plant	Inactive
Bay Petroleum Near Denver, Colo.	1.0	Petroleum products	Organic and inorganic	Primary	Inadequate	2,400	Addition	Inactive
Oriental Refining Co. Near Denver, Colo.	1.0	Petroleum products	Organic and inorganic	Lagoon	Adequate	2,000	None	-
Empire Petroleum Corp. Near Denver, Colo.	1.0	Petroleum products	Organic and inorganic	Lagoon	Adequate	600	None	-
Skelly Oil Co. Near Denver, Colo.	-	Petroleum products	Organic and inorganic	Separator	Adequate	(b)	None	-
Clear Creek	296.0							
Mile High Mining Co. Silver Plume, Colo.	53.5	Ore dressing	Inorganic	Lagoon	Inadequate	Not applicable	Replace	Inactive
Argo Mine Idaho Springs, Colo.	37.0	Ore dressing	Inorganic	-	-	Not applicable	-	-
Arthur Bartenier's Mill Idaho Springs, Colo.	37.0	Ore dressing	Inorganic	Lagoon	Adequate	Not applicable	None	-
A.G. & R. Mill Idaho Springs, Colo.	37.0	Ore dressing	Inorganic	-	-	Not applicable	-	-
Black Eagle Mill Idaho Springs, Colo.	37.0	Ore dressing	Inorganic	Lagoon	Adequate	Not applicable	None	-
Dixie Mill Idaho Springs, Colo.	37.0	Ore dressing	Inorganic	Lagoon	Adequate	Not applicable	None	-
Lombard Mill Idaho Springs, Colo.	37.0	Ore dressing	Inorganic	-	-	Not applicable	-	-
Old Ore Processing Mill Idaho Springs, Colo.	37.0	Ore dressing	Inorganic	-	-	Not applicable	-	-
Gauss-Mahoning Idaho Springs, Colo.	37.0	Ore dressing	Inorganic	-	-	Not applicable	-	-
Silver Spruce Mill Idaho Springs, Colo.	37.0	Ore dressing	Inorganic	Lagoon	Adequate	Not applicable	None	-
Wolftongue Mill Idaho Springs, Colo.	37.0	Ore dressing	Inorganic	-	-	Not applicable	-	-
Adolph Coors Golden, Colo.	17.8	Malt and beer	Organic	None	-	12,850	New plant(a)	Under construction
Great Western Sugar Co. Brighton, Colo.	283.9	Food and kindred products	Organic	Primary	Inadequate	180,000	Addition	Inactive
Kuner-Empson Brighton, Colo.	283.6	Food and kindred products	Organic	None	-	7,500	New plant	Inactive
Platteville Potato Assn. Platteville, Colo.	264.0	Food and kindred products	Inorganic	None	-	Not applicable	New plant	Inactive
St. Vrain Creek	253.0							
Kuner-Empson Longmont, Colo.	27.0	Food and kindred products	Organic	None	-	18,000	New plant	Inactive
Great Western Sugar Co. Longmont, Colo.	26.0	Food and kindred products	Organic	Primary	Inadequate	700,000	Addition	Inactive
Boulder Creek	26.0							
Coal Creek	7.0							
[illegible] Mine Dacono, Colo.	15.0	Coal mining	Mine drainage	Major	Adequate	Not applicable	None	-
Boulder Valley #3 Mine Dacono, Colo.	15.0	Coal mining	Mine drainage	Major	Adequate	Not applicable	None	-
Sterling Mine Dacono, Colo.	15.0	Coal mining	Mine drainage	None	-	Not applicable	New plant	Inactive
Gorham Mine Dacono, Colo.	15.0	Coal mining	Mine drainage	Major	Adequate	Not applicable	None	-
Shamrock Mine Dacono, Colo.	15.0	Coal mining	Mine drainage	None	-	Not applicable	New plant	Inactive
Imperial Mine Erie, Colo.	11.0	Coal mining	Mine drainage	None	-	Not applicable	New plant	Inactive
Morrison Mine Erie, Colo.	11.0	Coal mining	Mine drainage	None	-	Not applicable	None	-
Eagle Mine Erie, Colo.	11.0	Coal mining	Mine drainage	None	-	Not applicable	None	-
Lincoln Mine Erie, Colo.	11.0	Coal mining	Mine drainage	None	-	Not applicable	New plant	Inactive
Washington Mine Erie, Colo.	11.0	Coal mining	Mine drainage	Major	Adequate	Not applicable	None	-

Table IV-3. South Platte River Sub-Basin - Basic data on sources of industrial pollution - Industries discharging wastes directly to watercourses (cont.)

Receiving stream, name and location of industry¹	River miles from mouth	Type of industry	Type of waste produced	Treatment or other pollution control measures		Population equivalent (B.O.D.) discharged to watercourse	Project needs or equivalent control measures	Current status of industrial action
				Degree	Adequacy			
South Platte River (cont.)								
St. Vrain Creek	253.0							
Boulder Creek	18.0							
Coal Creek	7.0							
Erie Gorry Mine Erie, Colo.	11.0	Coal mining	Mine drainage	None	-	Not applicable	New plant	Inactive
Black Diamond #2 Mine Lafayette, Colo.	6.0	Coal mining	Mine drainage	None	-	Not applicable	New plant	Inactive
Hi-way Mine Lafayette, Colo.	8.0	Coal mining	Mine drainage	Major	Adequate	Not applicable	None	-
Thompson River	245.0							
Buckhorn Creek	32.0							
Walker Packing Co. Masonville, Colo.	1.4	Food and kindred products	Organic	Major	Adequate	(b)	None	-
Cherry Products Co. Larimer Co.	30.3	Food and kindred products	Organic	None	-	2,500	New plant	Inactive
Bovillo's Cherry Cider Loveland, Colo.	27.0	Food and kindred products	Organic	Major	Adequate	(b)	None	-
Kuner-Empson Loveland, Colo.	23.0	Food and kindred products	Organic	None	-	2,500	New plant	Inactive
Great Western Sugar Co. Loveland, Colo.	21.0	Food and kindred products	Organic	Primary	Inadequate	640,000	Addition	Inactive
Little Thompson River	5.5							
Great Western Sugar Co. Johnstown, Colo.	2.0	Food and kindred products	Organic	-	-	-	(d)	-
Beebe Draw	240.0							
Burr Farms Potato Co. LaSalle, Colo.	3.0	Food and kindred products	Inorganic	Minor	Inadequate	Not applicable	Addition	Inactive
Cache la Poudre River	234.0							
Kuner Pickle Co. Ft. Collins, Colo.	37.3	Food and kindred products	Organic	None	-	2,600	New plant	Inactive
Great Western Sugar Co. Ft. Collins, Colo.	36.0	Food and kindred products	Organic	Primary	Inadequate	710,000	Addition	Inactive
Great Western Sugar Co. Windsor, Colo.	27.2	Food and kindred products	Organic	None	-	210,000	New plant	Inactive
Tributary	7.0							
Great Western Sugar Co. Eaton, Colo.	7.0	Food and kindred products	Organic	Minor	Inadequate	140,000	Addition	Inactive
Greeley Rendering Co. Greeley, Colo.	6.0	Food and kindred products	Organic	Minor	Inadequate	1,700	Addition	Inactive
Associated Seed Growers, Inc. Greeley, Colo.	4.5	Food and kindred products	Organic	Minor	Inadequate	2,300	Replace	Inactive
Great Western Sugar Co. Greeley, Colo.	4.1	Food and kindred products	Organic	Primary	Inadequate	180,000	Addition	Inactive
Tributary	4.0							
Weld Co. Potato Growers Assn. Lucerne, Colo.	5.0	Food and kindred products	Inorganic	Minor	Inadequate	Not applicable	Addition	Inactive
Lucerne Potato Growers Lucerne, Colo.	5.0	Food and kindred products	Inorganic	Minor	Inadequate	Not applicable	Addition	Inactive
Crow Creek	227.0							
Colo. & Southern R.R. Shop Cheyenne, Wyo.	76.0	Transportation equipment	Organic and inorganic	Lagoon	Adequate	(a)	None	-
Union Pacific R.R. Shop Cheyenne, Wyo.	76.0	Transportation equipment	Organic and inorganic	None	-	-	New plant	Planning initiated
S. & S. Packing Co. Cheyenne, Wyo.	76.0	Food and kindred products	Organic	None	-	380	New plant	Inactive
Frontier Refining Co. Cheyenne, Wyo.	76.0	Petroleum products	Organic and inorganic	Lagoon	Adequate	3,900	None	-
Tioman Packing Co. Ft. Morgan, Colo.	184.6	Food and kindred products	Organic	Minor	Inadequate	600	Addition	Inactive
K. & B. Packing Co. Ft. Morgan, Colo.	184.6	Food and kindred products	Organic	Minor	Inadequate	430	Addition	Inactive
Great Western Sugar Co. Ft. Morgan, Colo.	184.0	Food and kindred products	Organic	Primary	Inadequate	450,000	Addition	Inactive
Beaver Creek	170.0							
Great Western Sugar Co. Brush, Colo.	6.0	Food and kindred products	Organic	None	-	250,000	New plant	Inactive
Sterling Packing Co. Sterling, Colo.	-	Food and kindred products	Organic	Lagoon	Adequate	(a)	None	-
Sterling Rendering Co. Sterling, Colo.	153.0	Food and kindred products	Organic	None	-	1,250	New plant	Inactive
Great Western Sugar Co. Sterling, Colo.	153.0	Food and kindred products	Organic	None	-	360,000	New plant	Inactive
Lodgepole Creek	90.0							
Union Pacific R.R. Sidney, Nebr.	55.7	Water softening	Inorganic	None	-	Not applicable	New plant	Inactive
Fuhr Packing Co. Sidney, Nebr.	55.7	Food and kindred products	Organic	None	-	330	New plant	Inactive
Sioux Ordnance Depot Sidney, Nebr.	55.0	Transportation equipment	Inorganic	Minor	Adequate	Not applicable	None	-
Great Western Sugar Co. Ovid, Colo.	0.2	Food and kindred products	Organic	None	-	290,000	New plant	Inactive
Union Pacific R.R. Julesburg, Colo.	90.0	Water softening	Inorganic	Lagoon	Adequate	Not applicable	None	-
E. R. Reichelt, Jr. Julesburg, Colo.	90.0	Food and kindred products	Inorganic	None	-	Not applicable	New plant	Inactive
Platte Valley Potato Growers Assn., Julesburg, Colo.	90.0	Food and kindred products	Inorganic	Lagoon	Adequate	Not applicable	None	-
Union Pacific R.R. Ogallala, Nebr.	57.2	Water softening	Inorganic	None	-	Not applicable	New plant	Inactive
Total						4,190,570		

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[1] Industries having separate outlets.
[a] Discharge to artificial lagoon--no outlet to watercourse.
[b] Discharge to land--no pollution reaches watercourse.
[c] New plant under construction will treat Coors industrial waste and municipal waste from Golden.
[d] Special processing of Steffen House molasses. Further study required.

Legislation controlling pollution has been notably inadequate in Colorado and Nebraska. The legislatures of these States should enact comprehensive water pollution control legislation. Wyoming's laws relating to pollution control are reasonably affective. All States should support their Water Pollution Control Agencies with adequate funds to permit affective operation.

Water released from Pathfinder Dam irrigates many acres in Wyoming and Nebraska

UPPER MISSOURI RIVER SUB-BASIN

This section is based on the "Upper Missouri River Drainage Basin - A Cooperative State-Federal Report on Water Pollution" published May 1952. Basic data were brought up-to-date as of January 1, 1953, by the State Water Pollution Control Agency of Montana.

General Description

For purposes of this report, the Upper Missouri River Sub-Basin is considered to include the headwaters of the Missouri and to terminate immediately below the mouth of the Milk River. It occupies a total of 81,600 square miles of which 72,000 square miles are in the State of Montana, a very small portion lies within Yellowstone National Park, Wyoming, and 9,700 square miles are in Canada. The area is 400 miles in length with a maximum width of 250 miles. That part of the Missouri River in this reach is approximately 600 miles long.

The region is relatively sparsely populated, averaging less than 3.6 people per square mile. In 1950, the Sub-Basin had approximately 250,000 inhabitants, which represents about 50 percent of the total population of the State of Montana. The major cities are Great Falls, Helena, and Bozeman, Montana, with 1950 populations of 39,006, 17,498, and 11,252 respectively.

The economy is rooted in the great and varied natural resources. The mountains are covered with extensive forests, and considerable quantities of gold, silver, lead, zinc, coal, and phosphate are mined each year. Oil and gas are produced from widely scattered fields. Snowfed streams flowing downward from mountains generate large quantities of electrical power and provide water for numerous irrigation projects. Soils of high fertility are found in numerous places but in most instances, need water in order to produce abundant yields of wheat, alfalfa, sugar beets and similar crops. The natural beauty of the mountains and waterways is becoming an increasingly important tourist attraction; revenue in Montana from the tourist trade now closely rivals that from agriculture or industry.

The potential of the water resources is being developed by local, State, and national interests. Development is greatly enhanced by the Missouri River Basin water and land conservation and development program which proposes to construct 19 new reservoirs in the region. The tremendous Fort Peck Reservoir has been in service since 1938. Its prime purpose has been to supply water for navigation and to ameliorate flood flows in the lower Missouri River, the middle and lower Mississippi River, and incidentally to produce power. Most of the new reservoirs will be multiple-purpose projects.

Water Uses

Some of the earliest water uses in the region were transportation and hydraulic mining. The use of water for placer mining, or jetting of gold from creek banks, was the basis for the present Law of Water Rights in Montana. The first water right established in the Upper Missouri Sub-Basin was acquired in Elkhorn Creek in Jefferson County in 1861.

Streams are used as the source of public water supply for 18 communities serving a population of 81,300 with 19,980,000 gallons daily. Forty-four communities use ground water sources to serve a population of 36,400 with 5,000,000 gallons per day. A most important function of streams is the removal and ultimate disposal of liquid wastes from municipalities and industries of the expanding economy.

Irrigation is an extremely important use of water in this area. There are about a million acres under irrigation. Large irrigation projects now exist in the Milk River valley, along the Sun and Marias Rivers, and in the valleys of the Madison, Gallatin, and Jefferson Rivers. Plans have been completed for some additional irrigation along the Missouri River, in the Sun River valley, and in the Marias River valley. Several other projects are still under study.

There is considerable hydroelectric powder development. The principal power plants are located at Black Eagle, Ryan, Rainbow, and Marony Dams in the vicinity of Great Falls. Other regulatory works and smaller power plants are located at Hebgen Reservoir on Madison River and Houser and Holter Dams on the Missouri River. Downstream at Fort Peck Dam, a 85,000 kilowatt generating plant has been installed by the Corps of Engineers. The present generating capacity of hydroelectric power installations totals 295,700 kilowatts. The Bureau of Reclamation is constructing a large multi-purpose reservoir at Canyon Ferry. After installation of generators at Canyon Ferry, together with proposed increases in the power production capacity at Fort Peck, a total of more than 455,000 kilowatts of power will be available from the waters of the Upper Missouri Sub-Basin. Other power installations are under study.

The Anaconda Copper Mining Company has a large smelter at Black Eagle, Montana, across the river from Great Falls, which electrolitically purifies copper and zinc. The smelter was located here in order to utilize the electricity produced at the nearby hydroelectric power plants, and to have available a sufficient volume of water for cooling purposes. The oil refinery at Great Falls is also dependent upon the river for its water supply. Water power is used to operate flour mills at Lewiston and Bozeman, Montana.

Trout fishing in the Upper Missouri Sub-Basin constitutes some of the finest in the nation. Thousands of anglers are attracted yearly by the splendid fishing afforded them in the Big Hole, Gallatin, Beaver Head, Wise, Madison, Sun and Dearborn Rivers, the Missouri River between Three Forks and the entrance of the Sun River, and the Musselshell River from its headwaters to Roundup. The streams mentioned are particularly well known, however there are innumerable tributaries that also offer excellent fishing. Rainbow, cutthroat, eastern brook, and brown trout and mountain white fish are found in abundance.

Some portions of the area have excellent big game hunting, particularly the Sun River region. Montana permits regular hunting seasons on grizzly bear, black bear, elk, mule deer, and white tail deer. There are also moose, mountain goat, and big horn sheep. Herds of antelope are scattered throughout the area. Other wild game of note include lynx, bobcat, muskrat, marten, raccoon, weasel, wolverine, cougar, coyote, wolf, beaver, mink, otter, rabbit, pheasant, grouse, and waterfowl.

There is little commercial navigation in the streams, however a considerable fleet of small power craft operate on Hebgen and Holter Lakes for the benefit of the tourist trade. The lake formed by Holter Dam extends through the "Gates to the Mountains", a scenic and historical area very popular with tourists. Hebgen Lake is considered to be one of the best fishing lakes in the entire Sub-Basin. Recreational areas now being developed on Hebgen Lake and on Fort Peck Reservoir for boating, swimming, and fishing will undoubtedly attract a greater number of tourists.

Much of the area is semiarid, with most of the precipitation occurring as snowfall. Streams originating in and flowing through the mountainous sections generally have stable flows while those originating in and flowing through the high plains usually have smaller and more erratic flows. Many of the streams are fed from natural hot springs. Such springs are found at Bozeman and Hot Springs in Gallatin County; Potosi, Ziegler, and Barkell Hot Springs in Madison County; Elkhorn and Jackson Hot Springs in Beaverhead County; Pipestone, Alhambra, and Boulder Hot Springs in Jefferson County; White Sulphur Springs in Meagher County; Helena Springs in Lewis and Clark County, and in the Geyser Basin of Yellowstone National Park. Natural springs at Great Falls, Lewistown, and Toston, Montana, have flows of 300,110 and 60 cubic feet per second respectively. Hydrologic data showing average and minimum mean monthly flows are presented in table UM-1.

Sources of Pollution

Most of the pollution problems are localized, affecting stream reaches for only a relatively short distance. Pollution from sources in Canada have not been considered in this report although they are believed to be only of minor importance.

Wastes are contributed from 51 municipalities and 10 separately sewered industries. These data are shown in tables UM-2 and UM-3 and summarized in tables 1 and 2, Part I. Municipal plants serve 132,560 people; connected industry increases the sewage load to a population equivalent of 134,480. Thirty-seven municipalities provide treatment although overall pollution reduction is estimated at only 8.8 percent. Separately sewered industries discharge wastes having a population equivalent of 5,200. Inorganic wastes such as rock flour and mine tailings,metallic ions, acids and alkalies, are responsible for serious pollution in several headwater streams.

Needs have been established for 14 new municipal plants, 15 replacements and 5 additions or enlargements. Industries require 1 new plant, 2 replacements, and 3 additions to existing plants. These needs are

Table UM-1. Upper Missouri River Sub-Basin - Hydrologic data - observed minimum monthly mean flows occurring for a calendar month during winter (Dec. Jan. Feb.) and summer (June, July, Aug. and Sept.) for period of record

River	Years of records studied	Area drained sq. miles	c.f.s. average discharge	Mean monthly low flow in c.f.s. observed	
				Winter	Summer
Beaver Head River Blaine, Mont.	13	3,630	395	329	24.2
Jefferson River Sappington, Mont.	19	8,980	2,133	900	160
*Madison River McAllister, Mont.	10	2,180	1,570	-	-
Gallatin River Logan, Mont.	24	1,805	906	380	160
*Missouri River Fort Benton, Mont.	30	24,600	7,690	3,000	1,600
Marias River Shelby, Mont.	17	2,610	774	58	86
Judith River Utica, Mont.	22	331	52	0.21	2.9
Musselshell River Harlowton, Mont.	24	1,130	145	10.0	0
*Milk River Lohman, Mont.	14	6,070	248	7.3	50

*Streams now regulated by upstream reservoirs.

Table [illegible]. Upper Missouri River Sub-Basin - Basic data on sources of municipal pollution

Receiving stream, name and location of municipality[1]	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) untreated waste	Waste treatment provided	Adequacy of treatment facilities: Cap'y	Adequacy of treatment facilities: Oper.	Population equivalent discharged to watercourse	Project needs	Current status of municipal action
Missouri River									
Jefferson River	2465.4								
Beaverhead River	44.0								
Dillon	40.0	3,200	3,240	None	-	-	3,240	New plant	Planning initiated
Twin Bridges, State Orphans Home	4.0	300	300	None	-	-	300	New plant	Inactive
[illegible] Creek	40.0								
Whitehall	3.0	1,600	1,700	Minor[2]	Sat.	Unsat.	1,600	None	-
Boulder River	48.0								
Boulder, State Training School	42.0	800	810	Minor[2]	Unsat.	Unsat.	480	Replace	Inactive
Three Forks	3.4	1,100	1,100	None	-	-	1,100	New plant	Inactive
Gallatin River	2464.0								
Gallatin Gateway Hotel	-	80	80	Minor[2]	Sat.	Sat.	40[b]	None	-
East Gallatin River	10.0								
Bozeman	31.0	12,000	12,140	Primary	Sat.	Sat.	8,400	None	-
Belgrade	-	680	710	Minor[2]	Unsat.	Unsat.	580[b]	Replace	Inactive
Manhattan	3.0	700	750	Minor[2]	Unsat.	Unsat.	600	Replace	Inactive
Trident	2448.0	180	140	Minor[2]	Sat.	Sat.	180	None	-
Townsend	2423.3	1,300	1,380	Primary	Unsat.	Unsat.	1,220	Enlarge	Inactive
Prickly Pear Creek	2372.3								
East Helena	13.6	1,180	1,180	Minor[2]	Unsat.	Sat.	1,080	Replace	Planning initiated
Ten Mile Creek	9.4								
Seven Mile Creek	3.0								
Ft. Harrison, V. A. Hospital	2.0	300	300	Minor[2]	Unsat.	Unsat.	270	Replace	Inactive
Helena	7.0	17,600	17,700	None	-	-	17,700	New plant	Plans approved
Helena, State Girls School	6.0	100	100	Minor[2]	Sat.	Sat.	60	None	-
Cascade	2306.0	600	480	None	-	-	440	New plant	Planning initiated
Smith River	2300.4								
White Sulphur Springs	110.0	1,000	1,000	None	-	-	1,000[b]	New plant	Inactive
Great Falls	2267.0	55,250	40,300	None	-	-	40,300	New plant	Inactive
Black Eagle	2262.0	1,300	1,350	None	-	-	1,300	New plant	Inactive
Ft. Benton	2220.0	1,850	1,880	None	-	-	1,900	New plant	Inactive
Marias River	2191.0								
Two Medicine River	287.0								
Glacier Park Station	158.0	200	200	Minor[2]	Unsat.	Sat.	180	Addition	Inactive
Glacier Park Hotel	155.0	-	-	Minor[2]	-	-	-	-	-
[illegible] Creek	282.0								
[illegible]	96.0								
[illegible] Creek	30.0								
Browning	1.0	1,600	1,650	Minor[2]	Unsat.	Sat.	1,300	Enlarge	Inactive
Browning, Blackfeet Indian Agency	10.0	300	320	Minor[2]	Unsat.	Unsat.	270	Replace[a]	Inactive
Cut Bank	20.0	2,700	2,700	Secondary	Unsat.	Unsat.	2,300	Replace	Inactive
Dry Creek	100.0								
Valier	30.0	660	680	Minor[2]	Sat.	Sat.	580[e]	None	-
Old Lake Bed	-								
[illegible]	Landlocked	710	710	Minor[2]	Sat.	Sat.	640[e]	None	-
[illegible]	168.0								
Shelby	7.0	3,000	3,000	None	-	-	3,000	New plant	Inactive
Pondera Creek	60.0								
Conrad	100.0	1,800	1,800	Minor[2]	Unsat.	Unsat.	1,600	Replace	Planning initiated
Cottonwood Creek	87.0								
[illegible]	40.0								
Chester	1.0	700	700	None	-	-	700[e]	New plant	Planning initiated
Teton River	1.8								
[illegible] Creek	150.0								
Choteau	1.0	1,600	1,600	Minor[2]	Unsat.	Sat.	1,200	Replace	Planning initiated
[illegible] Creek	110.0								
[illegible]	9.0	480	480	Secondary	Sat.	Sat.	180[e]	None	-
Arrow River	2128.0								
[illegible]	1.8								
[illegible]	Landlocked	270	270	Minor[2]	Unsat.	Unsat.	200[d]	Enlarge	Inactive
Judith River	2114.7								
Big Spring Creek	48.0								
Lewistown	10.0	6,800	6,800	Primary	Unsat.	Sat.	700	Addition	Inactive
Wolf Creek	10.6								
[illegible] Creek	60.0								
[illegible]	-	600	600	Minor[2]	Sat.	Sat.	280[e]	None	-
Musselshell River	1894.7								
Harlowton	260.0	1,700	1,740	Primary	Unsat.	Unsat.	1,480	Replace	Inactive
[illegible] Creek	238.0								
[illegible]	90.0								
[illegible] Creek	18.0								
[illegible]	20.0	210	210	Secondary	Sat.	Unsat.	180	None	-
Roundup	170.0	2,800	2,800	Primary	Unsat.	Unsat.	2,500	Replace	Planning initiated
[illegible] Creek	87.0								
[illegible] Creek	93.0								
[illegible]	18.0	600	600	Minor[2]	Unsat.	Unsat.	500	Replace	Inactive
Ft. Peck	1878.7	1,100	1,100	None	-	-	1,100	New plant	Planning initiated
Milk River	1887.4								
Big Sandy Creek	431.8								
Big Sandy	40.0	700	700	Secondary	Unsat.	Unsat.	630	Replace	Inactive
Sage Creek	28.0								
[illegible]	Landlocked	280	280	Minor[2]	Sat.	Sat.	300[e]	None	-
Havre	485.0	8,000	8,000	Primary	Sat.	Sat.	6,400	None	-
Chinook	448.4	2,200	2,250	Secondary	Sat.	Sat.	1,180	None	-
Thirty Mile Creek	380.0								
Harlem	7.0	1,100	1,100	Secondary	Sat.	Unsat.	290	None	-
Ft. Belknap	319.0	200	200	Primary	Sat.	Sat.	170	None	-
Malta	218.8	2,000	2,000	None	-	-	2,000	New plant	Inactive
Beaver Creek	120.0								
Saco	88.8	600	600	Minor[2]	Unsat.	Unsat.	550	Replace	Inactive
Hinsdale	121.1	700	700	Minor[2]	Unsat.	Unsat.	650	Replace	Inactive
Glasgow	80.0	3,800	3,820	None	-	-	3,800	New plant	Planning initiated
Nashua	24.0	700	700	Minor[2]	Sat.	Unsat.	500	None	-
Totals		132,060	134,400				122,670		

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[1] All municipalities listed are in the state of Montana. Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

[2] Septic tank.

[a] Or connect to an adequate existing sewer system.

[b] Sub-surface application.

[c] Effluent discharged to hay fields during summer and to the White River during winter.

[d] Pollution reaches watercourse only during wet weather.

[e] Discharge to land.

Table VI-3. Upper Missouri River Sub-Basin - Basic data on sources of industrial pollution - Industries discharging directly to watercourses

Receiving stream, name and location of industry¹	River miles from mouth	Type of industry	Type of waste produced	Treatment or other pollution control measures: Degree	Treatment or other pollution control measures: Adequacy	Population equivalent (B.O.D.) discharged to watercourse	Project needs or equivalent control measures	Current status of industrial action
Missouri River	2464.4							
Gallatin River	10.0							
East Gallatin River								
Bozeman Pea Cannery Bozeman, Mont.	-	Food and kindred products	Organic	Lagoon	Adequate	(a)	None	-
Great Northern R.R. Shops	2245.0	Transportation equipment	Organic and inorganic	Minor	Inadequate	-	Replace	Inactive
Phillips Oil Refinery	2245.0	Petroleum products	Organic and inorganic	Partial	Inadequate	-	Addition	Inactive
A.C.M. Reduction Plant	2245.0	Primary metal products	Inorganic	None	-	Not applicable	New plant	Inactive
Great Falls Meat Co. Great Falls, Mont.	2245.0	Food and kindred products	Organic	Minor	Inadequate	5,200	Replace	Inactive
Marias River	2181.0							
Cut Bank Creek	232.0							
Union Oil Refinery Cut Bank, Mont.	-	Petroleum products	Organic and inorganic	Lagoon	Adequate	(a)	None	-
[illegible]								
Texaco Oil Refinery Sunburst, Mont.	-	Petroleum products	Organic and inorganic	Lagoon	Adequate	(a)	None	-
Oil Refinery Kevin, Mont.	-	Petroleum products	Organic and inorganic	Lagoon	Adequate	(a)	None	-
Musselshell River	1994.7							
C.M.St.Paul & Pac. R.R.Shops Harlowton, Mont.	280.0	Transportation equipment	Organic and inorganic	Lagoon	Inadequate	-	Addition	Inactive
Milk River	1637.4							
R.R. Shops Havre, Mont.	461.0	Transportation equipment	Organic and inorganic	Minor	Inadequate	-	Addition	Inactive
Totals						5,200		

¹Industries having separate outlets.

ᵃWastes do not reach watercourses.

summarized in table 3, Part I. The cost of the recommended treatment program excluding interceptors, operation and maintenance is estimated at $3,200,000.

There is no known waste discharges contributing to interstate or international stream pollution.

There is need in Montana for comprehensive legislation sufficiently broad in scope to permit the State Water Pollution Control Agency to effectuate the comprehensive water pollution control program. Funds and personnel as necessary for such a program should be made available to the responsible State agency.

Big game and clean water in the upper Yellowstone Basin

YELLOWSTONE RIVER SUB-BASIN

A cooperative State-Federal report on water pollution for the Yellowstone River drainage area was published January 1952. The report, made current as of January 1, 1953, by the State Water Pollution Control Agencies of Montana, North Dakota, and Wyoming, forms the basis of this section.

General Description

The Yellowstone River Sub-Basin is located in north central Wyoming, southeastern Montana, and includes a small portion of western North Dakota. It is bounded by the Rocky Mountains on the west, the Missouri and Musselshell watersheds on the north, the Little Missouri and Cheyenne watersheds on the east, and by the Platte watershed on the south. The Sub-Basin is pear-shaped, having a length of about 440 miles and a maximum width of about 320 miles, the major dimension extending northeasterly and southwesterly. It has a total drainage area of 70,400 square miles, of which 35,925 square miles are in Montana, 33,735 in Wyoming, and 740 in North Dakota.

The relatively sparse population of the Sub-Basin totals about 250,000 of whom 42 percent reside in Wyoming, 54 percent in Montana, and 4 percent in North Dakota. Billings, Montana, is the largest city with a 1950 population of 31,724. Other communities with populations over 5,000 are Livingston, Glendive, and Miles City, Montana, and Sheridan, Wyoming. The rural population has steadily declined during the past three decades while the urban population has gained. The density of population is estimated at 3.6 persons per square mile.

The economic history of the area began in 1807 with the establishment of a trading post known as Fort Raymond at the mouth of the Big Horn River. Fur trade with the Indians attracted the first capital investment in the natural resources of the Sub-Basin, and for 60 years trading remained the principal occupation of whites who inhabited the region. The turn to agriculture as a principal means of livelihood began about 1870 with the formation of the great cattle ranches. Grazing was replaced by dry land farming, which is gradually being superseded by a return to livestock raising due to the uncertainty of a harvest in this semiarid region. Since 1920 an industrial exploitation of the rich oil fields and mines of the Sub-Basin has taken place, with the result that industry rivals agriculture in net value, and supports a large portion of the population.

This region is a highly favored recreational area. Over a million tourists a year visit Yellowstone National Park and other scenic places. The tourist trade is the third most valuable of all forms of business in Montana, and enjoys a similar position in Wyoming. All indications are that the tourist trade will soon become the leading source of income.

There are at present only a few controls on the main channel of the Yellowstone River, however authority has been granted by Congress to construct a dam at Mission, Montana, a short distance downstream from Livingston. Yellowtail Dam upstream from Hardin, Montana, on the Big Horn River has been authorized and Boysen Dam has been constructed between Riverton and Thermopolis, Wyoming, on the Big Horn River. The Montana State Water Conservation Board has constructed a dam on the Tongue River, one on Rock Creek, and another on Red Lodge Creek. In addition to those mentioned there are a number of small reservoirs furnishing water for irrigation projects on tributaries of the Yellowstone, principally in Wyoming.

The Yellowstone River and its tributaries play an important part in the Missouri River development program, as twenty-four reservoirs have been proposed for construction on these streams. Completion of the projects may have a marked effect not only on municipal water supplies within the Sub-Basin but also on such supplies taken from the main stem of the Missouri River below the mouth of the Yellowstone. It has been estimated that 23 percent of the silt in the Missouri River at Kansas City is contributed by the Yellowstone system. Much of this silt will be retained in reservoirs to be constructed on the Yellowstone, Big Horn, and Missouri Rivers.

Water Uses

The high mineral content of much of the ground waters has made their general use undesirable; surface waters are the principal source of domestic supply. Approximately 82 percent of the urban population is provided water derived from streams and lakes. Surface water, primarily from irrigation ditches, is used by many farm and ranch residents in preference to the highly mineralized ground waters.

A population of 82,500 is served with 13,170,000 gallons of water daily by 25 community systems that tap surface sources. Twenty-three systems securing ground water serve 18,800 people with 2,500,000 gallons daily.

Water taken directly from streams by industry greatly exceeds that supplied through municipal systems and is estimated at 70,000,000 gallons per day during periods of peak demand. Oil refineries and sugar refineries constitute the major users of water.

Irrigation has been practiced in this area since the 1860s. The Bureau of Reclamation and the States are constructing or have constructed vast irrigation systems. The irrigated lands support a large portion of the population and produce many valuable crops, including hay, dry beans, corn, and sugar beets, all of which grow well throughout the area.

The Yellowstone River, from its source in Yellowstone Park to Laurel, is a nationally famous trout stream and is one of the State's most popular winter fishing areas for whitefish. The tributaries of the Yellowstone as far downstream as the Big Horn River are important trout streams. These include the Shields, Boulder, Stillwater, Clarks Fork and its tributary Rock Creek, and tributaries of the Big Horn. Only limited fishing exists in the lower portions of the stream where the water is more turbid and the flow is less rapid. Much of the area, however, because of game fishing and other natural attractions, has become a veritable tourists' paradise. There is considerable wildlife in the area, principally antelope, deer, elk, moose, and beaver. There are also some bear and mountain lion. Chinese pheasants, other upland birds and waterfowl are found near irrigated lands throughout the region.

Potential hydroelectric power in the Yellowstone Sub-Basin has been estimated to be about 2.75 million kilowatts. Nine hydroelectric plants with a total installed capacity of 39,400 kilowatts are now operating to furnish power for the domestic and industrial consumers. Most of the hydroelectric plants are located in the headwaters.

Watering of livestock is also a valuable use of water. Cattle and sheep are raised in large numbers and great dependence is placed on streams as a source of water for them. The streams have been and must continue to be used extensively for the removal and ultimate disposal of municipal and industrial wastes.

It is to be anticipated that the new storage reservoirs will assist in regulating low stream discharges. The minimum mean monthly unregulated flow anticipated in both winter and summer once in five years and once in ten years is included in table Y-1. Most of the low flows occur during the winter months with concurrent ice cover.

Sources of Pollution

Review of data on municipal sources of pollution as given in tables Y-2 and Y-3 and summarized in tables 1 and 2, Part I, shows that 51 municipal sewage systems serve about 127,400 people. Thirty-four communities have sewage treatment facilities providing for approximately 60 percent of the sewered population; an estimated population equivalent of 99,150 discharged to streams indicates 22.4 percent removal of municipal pollution.

Twenty-two industrial plants with private outlets discharge wastes estimated as having a population equivalent of 1,321,600. Fifteen provide some degree of treatment although only 6 furnish adequate control measures.

Industries without treatment facilities produce by far the greatest quantity of pollutional material. Untreated wastes or wastes subjected to very minor treatment are contributed by five sugar refineries, one packing plant, and three canneries. Sugar refineries constitute the major source of organic pollution and contribute a great amount of waste to the streams during their fall and early winter seasonal operations. Other untreated wastes, principally waste oil and solvents, originate from railroad maintenance shops.

Industrial wastes containing oil, phenolic compounds, cyanide, rock flour, and other substances have taken a heavy toll of fishery values. Toxic materials have caused more damage to fish life than have organic wastes. Significant depletion of oxygen has never been reported in any of the streams in the Sub-Basin. There is evidence, however, to indicate that some public water supplies have been adversely affected by pollution. The use of polluted waters for the irrigation of food crops is a matter of considerable concern to health authorities.

Table Y-1. Yellowstone River Sub-Basin - Probable frequency of low mean monthly discharges

Location	Minimum summer flows c.f.s. occurring once in		Minimum winter flows c.f.s. occurring once in	
	5 years	10 years	5 years	10 years
Yellowstone River at Corwin Springs	973	930	642	549
Yellowstone River near Billings, Montana	2,274	1,812	1,587	1,457
Yellowstone River near Miles City, Montana	3,693	2,708	2,487	2,166
Yellowstone River near Sidney, Montana	3,280	2,731	2,394	2,107
Clarks Fork at Chance, Montana	178	154	133	126
Clarks Fork at Edgar, Montana	306	233	285	240
Rock Creek near Red Lodge, Montana	32	26	24	23
North Fork Popo Agie near Lander, Wyoming	12	7	10	7
Wind River at Riverton, Wyoming	273	256	189	155
Big Horn River at Kane, Wyoming	459	370	660	574
Big Horn River near St. Xavier, Montana	1,350	1,308	1,124	908
Owl Creek near Lucerne, Wyoming	0.5	0.0	1.0	0.0
Greybull River at Meeteetse, Wyoming	121	93	51	44
*Greybull River near Basin, Wyoming	2	1	23	14
Shoshone River below Buffalo Bill Reservoir	284	227	198	144
*Shoshone River at Byron, Wyoming	242	181	216	145
Little Big Horn River near Crow Agency, Montana	46	24	97	83
Tongue River near Acme, Wyoming	40	10	80	65
Goose Creek near Sheridan, Wyoming	14	11	5	4
Powder River near Arvada, Wyoming	3	1	29	11
Powder River at Moorhead, Montana	29	19	72	30
Powder River near Locate, Montana	35	5	40	20

*Differences from upstream gaging stations due to diversion and regulation.

Table Y-2. Yellowstone River Sub-Basin - Basic data on sources of municipal pollution

Receiving stream, name and location of municipality[1]	River miles from mouth	Population served by sewers	Population equivalent (B.O.D.) untreated waste	Waste treatment provided	Adequacy of treatment facilities Capy.	Adequacy of treatment facilities Oper.	Population equivalent discharged to watercourse	Project needs	Current status of municipal action
Yellowstone River									
Lake, Yellowstone Park, Wyo.	594.5	1,000	1,000	Minor[a]	Unsat.	Sat.	800	Replace	Under construction
Canyon, Yellowstone Park, Wyo.	579.9	1,550	1,550	Minor[a]	Unsat.	Sat.	1,250	Replace	Preliminary plans
Gardiner River	539.0								
Mammoth, Yellowstone Park, Wyo.	6.0	1,100	1,100	Secondary	Sat.	Sat.	220	None	-
Gardiner, Mont.	538.5	850	850	Minor[a]	Unsat.	Unsat.	760	Enlarge	Inactive
Livingston, Mont.	476.2	6,900[b]	7,000	None	-	-	7,000	New plant	Inactive
Big Timber, Mont.	436.6	1,280	1,390	Minor[a]	Unsat.	Sat.	1,020	Enlarge	Inactive
Columbus, Mont.	439.0	1,000	1,050	Minor[a]	Sat.	Fd.	900	None	-
Laurel, Mont.	484.0	4,000	4,000	Primary	Sat.	Sat.	2,800	None	-
Clarks Fork River	363.7								
Bear Creek	70.0								
Bear Creek, Mont.	11.0	150	150	Minor[a]	Sat.	Sat.	120	None	-
Bridger, Mont.	52.0	720	750	Secondary	Unsat.	Sat.	580	Enlarge	Inactive
Rock Creek	18.0								
Red Lodge, Mont.	55.0	3,000	3,000	Lagoon	Sat.	Sat.	(c)	None	-
Joliet, Mont.	12.0	400	400	Primary	Sat.	Sat.	180	None	-
Billings, Mont.	346.0	30,000[d]	30,000	Primary	Sat.	Sat.	20,000	Addition	Inactive
Big Horn River	279.4								
Wind River	336.0								
Riverton, Wyo.	1.5	4,500	4,500	None	-	-	4,500	New plant	Inactive
Popo Agie River	330.0								
Middle Fork	29.6								
Lander, Wyo.	10.0	4,000	4,000	None	-	-	4,000	New plant	Inactive
Training School near Lander, Wyo.	10.0	600	600	Secondary	Sat.	Sat.	150	None	-
Little Popo Agie River	22.3								
Hudson, Wyo.	0.5	200	200	None	-	-	200	New plant	Inactive
Little Wind River	15.0								
Trout Creek	19.3								
Shoshone Indian Reservation Headquarters at Fort Washakie, Wyo.	10.0	250	250	Secondary	Sat.	Sat.	50	None	-
Thermopolis, Wyo.	270.4	4,000	4,000	None	-	-	4,000	New plant	Final plans approved
Hot Springs State Park Thermopolis, Wyo.	270.4	250	250	None	-	-	250	New plant	Under construction
Worland, Wyo.	229.0	4,000	4,000	None	-	-	4,000	New plant	Inactive
Wyoming Institution for Boys Worland, Wyo.	229.0	200	200	Secondary	Sat.	Sat.	100	None	-
Basin, Wyo.	195.3	1,500	1,500	None	-	-	1,500	New plant	Inactive
Greybull River	183.0								
Meeteetse, Wyo.	53.8	400	400	Minor[a]	Sat.	Sat.[g]	270	None	-
Greybull, Wyo.	1.5	1,900	1,900	None	-	-	1,900	New plant	Inactive
Shoshone River	136.2								
Cody, Wyo.	60.4	3,800	3,800	None	-	-	3,800	New plant	Inactive
Bureau of Reclamation Camp	50.0	200	200	Primary	Sat.	Sat.	150	None	-
Bitter Creek	27.0								
Powell, Wyo.	8.0	1,200	1,200	None	-	-	1,200	New plant	Inactive
Lovell, Wyo.	11.5	3,000	3,000	None	-	-	3,000	New plant	Inactive
Hardin, Mont.	40.5	1,800	1,800	Minor[a]	Unsat.	Sat.	1,440	Replace	Inactive
Little Big Horn River	40.0								
Lodge Grass, Mont.	77.3	840	840	Lagoon	Unsat.	Unsat.	680	Replace	Inactive
Crow Agency, Mont.	14.0	800	800	Primary	Unsat.	Unsat.	600	Replace	Plans initiated
Hysham, Mont.	260.0	280	280	Minor[a]	Unsat.	Unsat.	250	Replace	Inactive
Forsyth, Mont.	230.8	2,000	2,000	Primary	Unsat.	Unsat.	1,600	Enlarge	Inactive
Rosebud Creek	218.0								
Lame Deer Creek	80.0								
Lame Deer, Mont.	6.0	50	50	Primary	Sat.	Sat.	40	None	-
Fort Keogh, Mont.	186.0	80	80	None	-	-	80	New plant	Inactive
Tongue River	181.5								
Ranchester, Wyo.	236.0	200	200	Secondary	Sat.	Sat.	(c)	None	-
Big Goose Creek	211.7								
Sheridan, Wyo.	11.0	15,000	15,000	Secondary	Unsat.	Sat.	7,000	Enlarge	Inactive
Veterans Hospital Sheridan, Wyo.	11.0	1,000	1,000	Secondary	Sat.	Sat.	100	None	-
Little Goose Creek	11.0								
State Home for Girls Sheridan, Wyo.	1.0	80	80	Secondary	Sat.	Sat.	20	None	-
Indian Boarding School Birney, Mont.	151.3	50	50	Minor[a]	Sat.	Sat.	40	None	-
Miles City, Mont.	180.8	7,200	7,240	None	-	-	7,240	New plant	Inactive
Powder River	146.6								
Salt Creek	353.0								
Midwest, Wyo.	50.0	700	700	Primary	Sat.	Sat.	500	None	-
Clear Creek	210.0								
Buffalo, Wyo.	80.0	350	350	None	-	-	350	New plant	Inactive
Buffalo, Wyo. #1 Plant	80.0	3,000	3,000	Minor[a] + chlorination	Unsat.	Sat.	2,400	Enlarge	Inactive
Buffalo, Wyo. #2 Plant	80.0			Minor[a] + chlorination	Unsat.	Sat.		Enlarge	Inactive
State Old Soldiers Home Buffalo, Wyo.	80.0	60	60	Secondary	Sat.	Sat.	10	None	-
Broadus, Mont.	138.0	500	500	None	-	-	500	New plant	Inactive
Terry, Mont.	134.5	500	500	Minor[a]	Sat.	Sat.	490	None	-
O'Fallon Creek	128.5								
Sandstone Creek	25.0								
Baker, Mont.	20.0	1,600	1,600	Primary	Unsat.	Unsat.	1,600	Replace	Inactive
Glendive, Mont.	98.1	5,130	5,130	None	-	-	5,130	New plant	Inactive
Sidney, Mont.	28.0	3,000	3,040	None	-	-	3,040	New plant	Inactive
Drainage Ditch	9.0								
Fairview, Mont.	2.0	1,200[e]	1,200	Primary	Sat.	Sat.	960	None	-
Totals		127,370	127,740				99,150		

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[1] Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

[a] Sludge discharged to river.

[g] Septic tank.

[b] Including 160 people that discharge to railroad sewer.

[c] No discharge to watercourse.

[d] 2,000 people of West Billings should construct sewers and be connected to Billings, Montana, treatment plant.

[e] Includes 35 people of East Fairview, North Dakota, that are connected to Fairview sewers.

Table V-3. Yellowstone River Sub-Basin - Basic data on sources of industrial pollution - Industries discharging wastes directly to watercourses

Receiving stream, name and location of industry¹	River miles from mouth	Type of industry	Type of waste produced	Treatment or other pollution control measures		Population equivalent (B.O.D.) discharged to watercourse	Project needs or equivalent control measures	Current status of industrial action
				Extent	Adequacy			
Yellowstone River								
Northern Pacific R.R.Shops Livingston, Mont.	474.2	Transportation equipment	Organic and inorganic	Partial	Inadequate	-	Replace or other control measures	Inactive
Co-Op Oil Refinery Laurel, Mont.	364.0	Petroleum products	Organic and inorganic	Partial	Inadequate	-	Addition	Inactive
Northern Pacific R.R.Shops Laurel, Mont.	364.0	Transportation equipment	Organic and inorganic	Partial	Inadequate	-	Addition	Inactive
Clarks Fork River	363.7							
[illegible] Oil Refinery Badger Basin, Wyo.	85.0	Petroleum products	Organic and inorganic	Partial	Adequate	(a)	None	-
Rock Creek	18.0							
Red Lodge Cannery Red Lodge, Mont.	55.0	Food and kindred products	Organic	Minor	Inadequate	-	Addition	Inactive
Great Western Sugar Company Refinery, Billings, Mont.	346.0	Food and kindred products	Organic	None	Inadequate	500,000	New plant or other control measures	Inactive
Continental Oil Co. Refinery Billings, Mont.	346.0	Petroleum products	Organic and inorganic	Partial	Adequate	-	None	-
Carter Oil Co. Refinery Billings, Mont.	346.0	Petroleum products	Organic and inorganic	Partial	Adequate	-	None	-
Pierce Packing Co. Billings, Mont.	346.0	Food and kindred products	Organic	Partial	Inadequate	12,500	Replace or other control measures	Inactive
Midland Empire Packing Co. Billings, Mont.	346.0	Food and kindred products	Organic	None	Inadequate	5,000	New plant or other control measures	Inactive
Big Horn River	279.4							
Empire State Oil Refinery Thermopolis, Wyo.	270.4	Petroleum products	Organic and inorganic	Partial	Inadequate	-	Enlarge	Inactive
Holly Sugar Refinery Worland, Wyo.	229.0	Food and kindred products	Organic	Minor	Inadequate	200,000	Replace or other control measures	Inactive
Pure Oil Refinery Worland, Wyo.	229.0	Petroleum products	Organic and inorganic	Good	Adequate	-	None	-
Texas-Gulf Sulfur Plant Worland, Wyo	229.0	Petroleum products	Inorganic	Partial	Adequate	-	None	-
Shoshone River	136.2							
Husky Oil Refinery Cody, Wyo.	60.4	Petroleum products	Organic and inorganic	Partial	Inadequate	-	Replace or other control measures	Inactive
Tributary								
Cowley Canning Co. Cowley, Wyo.	- -	Food and kindred products	Organic	Minor	Inadequate	4,100	Replace	Inactive
Great Western Sugar Co. Refinery, Lovell, Wyo.	11.5	Food and kindred products	Organic	None	Inadequate	200,000	New plant or other control measures	Inactive
Ohio Oil Refinery Lovell, Wyo.	11.5	Food and kindred products	Organic	Partial	Adequate	-	None	-
Holly Sugar Co. Refinery Hardin, Mont.	40.5	Food and kindred products	Organic	None	Inadequate	200,000	New plant or other control measures	Inactive
C.M.St.Paul & Pacific R.R.Shop Miles City, Mont.	180.8	Transportation equipment	Organic and inorganic	None	Inadequate	-	New plant or other control measures	Inactive
Northern Pacific R.R. Shop Glendive, Mont.	92.1	Transportation equipment	Organic and inorganic	None	Inadequate	-	New plant or other control measures	Inactive
Holly Sugar Co. Refinery Sidney, Mont.	28.0	Food and kindred products	Organic	None	Inadequate	200,000	New plant or other control measures	Inactive
Total						1,321,600		

[1] Industries having separate outlets.

[a] Waste does not reach Clarks Fork River.

Municipal sewage treatment needs have been established as follows: 18 new plants, 7 replacements, and 8 enlargements or additions. Industrial needs are shown as 7 new plants, 5 replacements and 4 additions or enlargements. These needs are tabulated in table Y-3 and table 3, Part I. The cost of constructing recommended abatement facilities at municipal and industrial sources of pollution is estimated at $10,200,000. This does not include interceptors, operation, or maintenance.

The Yellowstone and several of its tributaries are interstate streams. Interstate pollution has not been encountered except in the Big Horn River. This has been in the nature of excessive taste and odors in public water supplies taken from the Big Horn River by Montana cities. The cause of the tastes and odors has not been definitely established, however, it is allegedly produced by industrial wastes discharged to the streams in Wyoming.

The effect of the regulation of streams on sewage and industrial waste disposal needs has not yet been ascertained. Additional information concerning reservoir releases will be needed before an evaluation can be made. The removal of settleable materials from both domestic sewage and industrial waste is recommended by the State Water Pollution Control Agencies as a minimum requirement for controlling pollution. There are no known sources of pollution within the North Dakota section of the Sub-Basin.

The State Water Pollution Control Agencies concerned have been restricted in their operation by insufficient funds and personnel, and inadequate legislative backing. In 1951, however, pollution control legislation of the State of Wyoming was considerably strengthened and broadened and is apparently adequate for controlling pollution deleteriously affecting any legitimate water use. The antipollution legislation of the State of Montana is only enforceable when pollution affects public water supplies or endangers the public health.